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A Weekly Journal of the Mining and Mineral Industries

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February 5, 1921

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By A. M. Oliver

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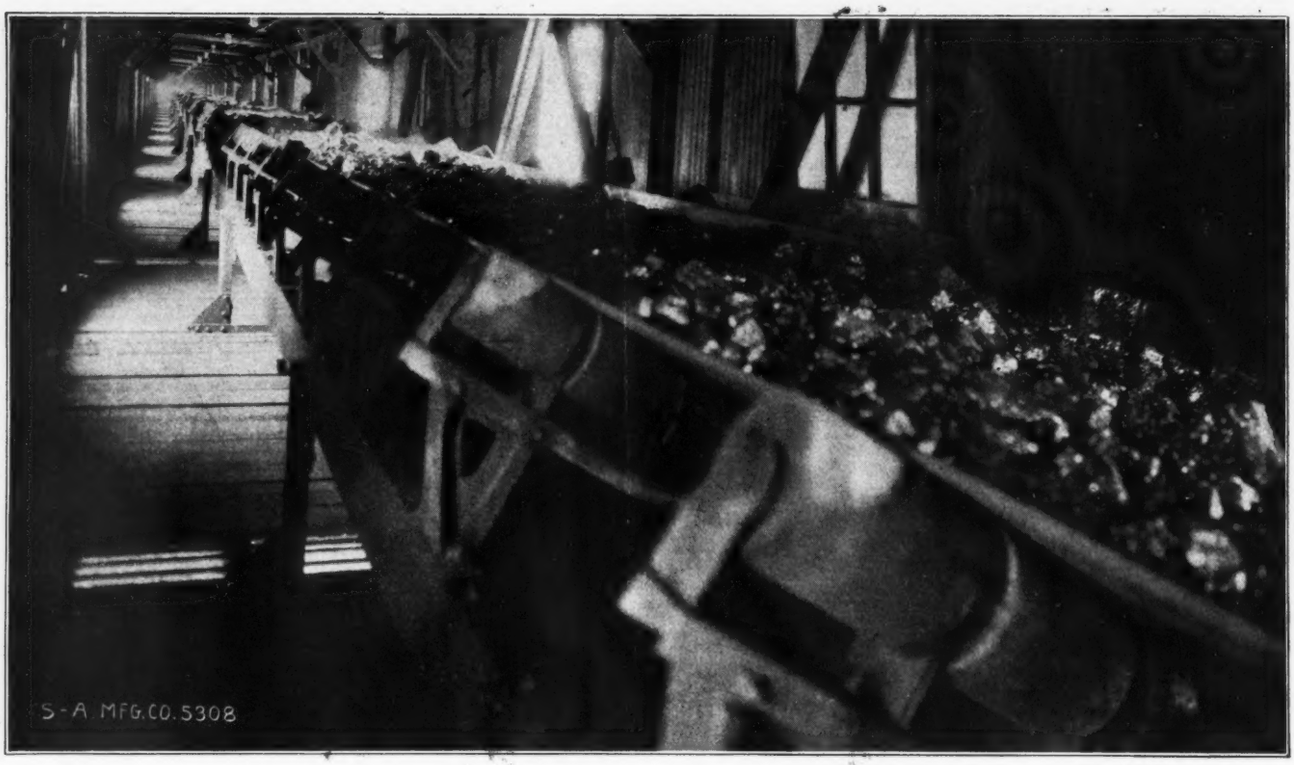

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The Long Look Upward

IT IS THE GENERAL OPINION that business conditions have passed the main crisis of deflation and that the danger of a financial panic is over. It has been said and written many times that only the Federal Reserve banking system averted a worse panic than any we have seen in our generation. Concerning that we cannot say: it would appear, however, that there is enough paper extant to cushion almost any shock.

Fundamentally, we have every ground for prosperity: we lack neither raw materials, nor funds, nor willing hands, nor an essentially sound and stable government. General business conditions, we are told, should gradually improve. This, it is argued, has been indicated by the rise in the stock and bond markets, which has been marked since the first of the year. The quick absorption of new bond offerings indicates an abundance of funds ready for investment, and renders the theory of threatening preponderance of "frozen credits" doubtful. Evidently, if the banks are short of ready money for investment, others have it in plenty.

The next problem, then, is to nurse our markets, at home and abroad. At home, reasonable and declining prices for finished products alone will tempt sustained buying. Part of this may be accomplished by economical and more thorough business methods, tending to lessen the wide gap between the price of raw material and finished product—squeezing the undue profits out of the multitudinous middlemen. In the metals, as we have before editorially indicated, special investigation should be here applied, and may easily result in a higher price to the miner and a lower price to the consumer.

For those important metals which we are organized to produce in excess of our requirements, and so depend absolutely on a good export market for prosperity, as is unequivocally the case with copper, the problem is not how to dispose of our product, but how to get paid for it. Impoverished Europe needs our metal, but cannot pay with gold: and we get weary of paper in the long run. Our bankers like to pay with paper, but will not accept it in payment, demanding, with strange insistence, gold. This problem, then, resolves itself into one of international finance, and the solution can hardly come about without the co-operation of the United States. In this one respect our export industries, including copper, are really dependent, for the immediate future, on the foreign policy of our new administration. The problem is something more than the extension of credits to foreign purchasers for a short or a long term. The War Finance Corporation has been revived for this purpose: and the American Bankers' Association has organized a $100,000,000 corporation, the Foreign Trade Financing Corporation. But the Copper Export Association, organized under the Webb Law, has the same general purpose as the War Finance Corporation, to facilitate export trade, and is well financed.

The problem still remains as to how finally to collect. As a concerted banking arrangement, it is difficult to see how this can be done; and this was President Wilson's view when he vainly vetoed the re-establishment of the War Finance Corporation. If categorical methods fail, the problem of the liquidation of foreign credit will be solved in time by the private transfer of American gold to the smitten countries in the form of investments made attractive by the low rates of exchange and encouraged by the Foreign Trade Financing Corporation, and by what is more important, the importations of European produce—an element in the situation that is giving and will give the incoming administration much trouble in its consideration of tariff problems. An ironing out of the great inequalities of exchange and credit is bound to take place in the long run, unless new wars, revolutions, and repudiations occur.

Electricity in the Mining Industry

THE commercial application of electricity hardly existed before the present generation; in fact, it is only in the last twenty or thirty years that the most apparent use of electricity—in lighting and in street railways—has become common. The electric automobile was seen fairly often on the streets ten or fifteen years ago, but is now almost entirely superseded by gasoline-driven vehicles. The general utilization of electricity in the mining industry is even more recent: we are tempted to speak of it here by the announcement of the Bunker Hill & Sullivan company of its intention to erect a $1,000,000 electrolytic zinc plant at Kellogg, Idaho.

Copper was the first of the important metals to be electrolytically refined on a large scale, the first plant in this country to use the process being that of the Balbach company, which was established in 1883. Now, practically all American copper containing appreciable amounts of the precious metals is refined by this process. The electroytic refining of zinc is much more recent, but the list of plants is constantly growing, and includes Anaconda, the Consolidated plant at Trail, British Columbia, and several other smaller plants in various parts of the world.

Poor recoveries retarded the adoption of the electrolytic refining of zinc until recently. The importance of pure solutions was not realized. With the present scientific development of the process, the cost of power is perhaps the most important item to be considered. It is now almost certain that electrolytic zinc has a brilliant future and may displace "Prime Western" as a standard grade, just as electrolytic copper has displaced "lake." In districts where complex lead-zinc ores are found, an electrolytic zinc plant would seem to be particularly useful.

The electrolytic refining of doré bullion, developed by Dr. Moebius thirty or forty years ago, has received wide application. Within the last decade tin and nickel

have been added to the list. The American Smelting & Refining Co. has a plant at Perth Amboy where the troublesome Bolivian tin concentrates are smelted and electrolytically refined, the product commanding about the same price as the high-grade "Straits" tin. Part of the International Nickel Co.'s product is electrolytically refined, and the new plant of the British America Nickel Co. at Deschenes, Que., uses the Hybinette electrolytic process entirely, thereby permitting the recovery of platinum and palladium. Electricity is certainly coming to be the principal agent in metal refining.

In smelting, the application of electricity is still narrow and in general confined to special complex problems. Certainly no electric reduction process is being applied on a large scale to iron, copper, lead, zinc, tin, gold, or silver ores. Aluminum is the most important metal which is commonly electrically smelted. Still, electricity plays an important part in the mill and smelter. For pumping, compressing air, rail transportation, crane operation, furnace tilting, flue-dust recovery, and minor uses it is almost indispensable in the smelter. In the mill, concentration by electrostatic methods has found only limited applications, but, as in the smelter, electricity is possibly the chief source of power.

Electric hoisting in mines has been developed to an extent undreamed of a few years ago. The Inspiration hoist, for example, is a revelation in automaticity. Mine lighting has been revolutionized, and the old reliable mule for tramming is gradually becoming extinct. With mechanical loading machines coming into use, the drill is about the only other tool in a mine on which our electrical research engineers can concentrate.

High Prices for Manufactured Copper and Silver

WE REPRODUCE on page 256 a letter from a Canadian silver producer whose opinion coincides with the ideas recently expressed in an editorial in these columns on "Why Is Copper a Luxury?" So far, no one has yet come forward with any justification for the apparently extravagant prices asked for many copper products. One reason, we suspect, for the high prices, is that most articles made of copper are not produced on a quantity basis and must meet the high manufacturing costs which are charged to the production of a side line for which the demand is small. A reduced price followed by intelligent advertising would, we feel, so increase the sales as to enable manufacturing costs to be greatly reduced and make them more comparable with those of steel and galvanized products.

Mr. Bourne points out that the demand for sterling-silver products is also restricted by unjustifiably high prices. The price of silverware we know is high, for we had occasion to buy a wedding present recently. We were informed that no reduction in the price had been made since silver sold at $1.35 an ounce. As the price asked represented several times the bullion value of the silver contained in the article, the price of the raw material seems to have little effect. Labor is, of course, the largest factor in most manufacturing costs, and wages have receded only slightly toward the pre-war scale. And yet the jewelry trade is unalterably opposed to the McFadden Bill, which would tax that industry $10 per ounce more for its gold, and which would in all probability add little or nothing to the selling price, if we may judge from the general conditions already mentioned.

The Solution of the Apex Muddle

WE CALL special attention to a letter on page 255 in this issue from Mr. L. S. Ropes, on the subject of the apex law, in which he truly points out that criticism should be constructive as well as destructive, and gives as the solution private agreements establishing vertical boundary rights between the owners of contiguous mining properties.

We wish to indorse Mr. Ropes' suggestion unqualifiedly. That the law which gives extralateral rights to the owner of a lode apex has proved absolutely impracticable of equitable interpretation is a conclusion that we have editorially voiced: and this opinion is held almost unanimously by mining engineers. The question is, what to do about it. It is easier to make an omelette than to unscramble the eggs. By our present system of court trials the omelette is dumped into the fire. Alteration of the law of course suggests itself, and this has been attempted several times, without getting action. There is pending, however, the report of a special committee, consisting of W. R. Ingalls, chairman, with Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, L. D. Ricketts, Horace Winchell, and James R. Jones. To Mr. Jones, then connected with the Bureau of Mines, belongs, we believe, much of the credit for research and legal study in drafting the views of the committee into a bill, which has been placed informally in the hands of the committees on Mines and Mining of the Senate and the House in Washington. It has not yet been formally acted upon and made public by the entire committee, however; but in our issue of July 3, 1920, the gist of it was given in our Washington News. This proposal establishes vertical boundary lines in the future, but, of course, this cannot be made retroactive, and can apply only to claims located hereafter. As most mining claims in the United States have probably already been located, and the extralateral rights of these, one against the other, cannot be alienated, our apex difficulties, despite mining law revision, promise to go on, unless the pressure exerted by those most vitally interested can be made effective, for a thousand years.

The indicated remedy is what sometimes becomes necessary in an emergency—for mine owners to "take the law into their own hands." Private agreements establishing vertical boundaries can in most cases be made between owners of contiguous claims, if the attempt be made, as a matter of principle, in the beginning. After ore is found, certain strong human emotions dwarf judgment and the universal instinct for fairness and generosity, and these emotions produce the fight for booty, which is so gainful to the lawyer and the professional witness and so wasteful of time, talent, and of investors' resources.

Mr. Ropes specifies Bisbee as a camp where this beneficent principle has been established. Leadville is another instance where the absurdity and ruinousness of the apex law became evident in early suits, and the mine owners "took the law into their own hands" and established vertical boundaries, to their vast profit and contentment. Even in Tonopah, which has been the scene of bitterly fought apex controversies, a number of vertical boundary agreements were early made, and all the makers profited thereby.

Boycott the apex law! Render it a dead letter. Make your vertical boundary agreements. Do it now! It will be a patriotic act, and a profitable one.

WHAT OTHERS THINK

The Law of the Apex

The Utah Consolidated-Utah Apex suit has brought out considerable discussion. In general, with reference to the question What is a lode? I wish to express my approval of your editorial of Jan. 15, particularly the following: "But we were not discussing the matter with the lawyer's mind and standards, but those of the geologist and engineer. Equity, not decisions; common sense, not arguments; what should be, not what is and has been"; also the quotation therein from a "distinguished engineer."

There is more that is suggestive in this case and the discussions than quibbling over an unfortunately chosen expression, which should point out the necessities for changes in the mining laws. Recalling House Resolution 12,275, Feb. 25, 1916, by Representative Foster, an effort was initiated to amend the mining laws as affecting locations on public lands. War measures superseded all peace-time measures, and nothing further has been heard from this resolution—it were better for the mining industry if nothing more is heard of it, as written.

Nevertheless, the subject is a live issue and should be taken up and constructive legislation passed which will do away with such costs, as "it cost two mining companies over half a million dollars"; a direct loss to the stockholders.

Getting away from the public lands, for example, I wonder where the court would be, the lawyers, and the geological witnesses, in dealing with such formations as occur along the Gogebic Range, in Michigan and Wisconsin—their isolated deposits of iron ore; some cropping at the surface; others entirely subsurface in occurrence, and, in all, with no veiny interconnections? There they would lack the "limestone" even, on which to predicate a "broad lode" theory.

Am I mistaken in assuming a more or less marked analogy between the general geology of the Utah district mentioned and that of Bisbee, Ariz.? A sedimentary formation, including limestone strata; a porphyry intrusion in itself more or less mineralized; *occurrences* (to be circumspect in classification) of commercial, metalliferous ores within the limestone strata in this particular, local section of a formation which may, originally, have covered thousands of square miles and yet exists, unmineralized, without the camp.

Bisbee! One of the foremost copper camps of the world. Will someone cite legal decisions, some current litigation over the right of the apex, in the Bisbee camp? No? Here is something to think over: Compare the history of the legal entanglements between Bisbee operators and those of Bingham, of Butte, and of the Cœur d'Alenes. I doubt if the majority of your readers are cognizant of the conditions, in Bisbee, which account for the contrast. With the advent of new operators in the Bisbee camp and the acquisition of large groups of claims by the several development organizations, it was at once recognized that complications would arise over rights if an attempt was made to base operations on the usual lines of the apex law. The result was an agreement among all the large interests to observe vertical bounding planes to their respective holdings; a simple solution and one immensely profitable to their stockholders, when the vast waste of resources in litigation in other camps is considered.

The Utah Consolidated-Utah Apex suit and its waste of assets by both companies afford an example of the futility of the existing mining laws to meet the exigencies of vastly altered, economic, mineral conditions. It presents an opportunity to point out the necessities of radical changes in the laws, and the Bisbee agreement, backed by the practices of the older mining regions, not effected by the Federal mining laws, suggests the solution.

L. S. ROPES.

Helena, Mont.

The Legal Status of Oil-Shale Deposits

Referring to "The Legal Status of Oil-shale Deposits on the Public Domain," by James R. Jones, in *Engineering and Mining Journal* of Jan. 8, I wish to offer a correction to the statement under the subhead "Limitations on Size of Lode Claims," that "the discovery should have been well identified either by means of a shaft at least ten feet deep from the lowest rim, or by an open cut, crosscut, or tunnel of the same depth, or an adit at least ten feet in along the lode. . . ."

As Mr. Jones is referring in this paragraph to the Federal law, the natural assumption is that such an opening is required by Federal statute, but this is not the fact. Federal law requires only a discovery, and if this is evident on the surface, no opening to expose it is necessary. Most of the Western states, however, by laws of their own, require a shaft or other opening at the discovery point. I am writing this from the field, where I have no reference works on the point, but I think that California and Utah are the only states which do not require such an opening.

Regarding the width of lode claims, Colorado is the only state in which any restriction is placed on the 300 ft. each side of the lode line provided by Federal statute. Here the width is 150 ft., and until 1912 it was only 75 ft. in four counties—Gilpin, Clear Creek, Summit, and Boulder.

At one time South Dakota had a law allowing only 150 ft. each side, but that was repealed long ago. Prior to our present mining code, the size of claims was a matter of local regulation, and many irregularities existed. In many districts in California and Colorado, 50 ft. x 3,000 ft. was a size prescribed.

Many of these local regulations were very interesting. I once had occasion to look up the status of a piece of ground in California which was 600 ft. x 3,000 ft. I naturally supposed that it consisted of two regulation size claims, but found that it dated back to the 50's, and consisted of one claim with twenty-nine locators. On inquiry, I found that it had been located in accordance with a local rule giving each person 300 ft. on each side of the lode but only 100 ft. along it, but giving an extra 100 ft. to the discoverer of a new lode. Hence,

with an extra 100 ft. for discovery, the twenty-nine locators were entitled to 3,000 ft., which was the limit in length for one claim.

Throughout the old rules and customs the lode and not surface area was the basis of location. This practice was followed out in formulating our present code, and was made the basis of the apex law, with its attendant grief. As I have no desire to "start something," however, I shall not pursue that point any farther.

San Francisco, Cal. LEROY A. PALMER.

Expensive Copper and Silver Products

I have read with much interest your article regarding the limited use of copper, due to the high price of products of that metal. The same state of affairs exists in the silver industry. The name "sterling silver" means, in the arts, that the purchaser pays $2 or $3 per oz. for silver that costs the manufacturer only 80 or 90c. (in Canada).

In the mining business tons of copper could be used where it would give infinitely better service than iron, but the first cost is prohibitive, and the buyer continues to buy iron and renew it every few years.

Thirty or forty years ago practically all kitchen utensils were made of copper, and gave years of good service. The same can be said of the hardware used in shipbuilding and in general building applications. The old serviceable solid copper or brass trimmings are now replaced by a cheap lacquer or imitation copper article that a few cleanings will destroy. Few people seem to realize that it is money well spent to buy something that will, like copper or brass, give good service and then fetch a good price as scrap.

All producers of metal should take a little interest in the sales department of their product, and find out why a pound of manufactured copper cannot be placed on the market at a reasonable price. They can also help the mining business along if they will themselves use more of their own product. If any intelligent man will follow the evolution of a pig of lead or a pound of copper from the furnace to the user, he will not be surprised that the public look upon these metals as being in the category of gold and diamonds.

Your paper was most timely, and I hope you will follow it up. F. J. BOURNE,

Cobalt, Ont. Manager, Bailey Silver Mines, Ltd.

Postponement of Assessment Work

Your attack on the hundreds of owners of unpatented mining claims with a blanket classification of "Gamblers in Mining Claims" is unjustifiable. The urgent request for an exemption or extension was made, and petitions were signed by hundreds of men actively engaged in developing their respective districts, for the same reason that the miners and producers asked for the gold bonus.

The conditions in mining in general and in the low-grade gold camps in particular are deplorable, as you have stated in many issues of your publication, and the owners of unpatented mining claims belong, as you well know, to the poorer classes who would rather develop their properties than pay taxes on idle patented ground, but are unable to pay the prevailing fancy prices for powder, fuse, caps, and tools.

You have been boosting for the McFadden Bill, which, if passed, means more than relief to the producing companies. Cost of supplies and materials is one of the main reasons for asking for a higher price of gold per ounce, and thereby overcoming the difficulty of raising money for mining enterprises. These same conditions affect the small owner in regard to assessment work, and it is about time to adjust your ideas and encourage *all* those engaged in mining, not alone the large companies, which are able to take care of themselves anyway.

Incidentally, I would like to know the percentage of owners of unpatented mining claims who were able to spend this winter in California from money saved because of the extension of time on assessment work.

Deadwood, S. D. A. T. ROOS.

A View of the Copper, Lead, and Zinc Markets

Copper is a serious topic of conversation in mining circles in New York. Bankers are no less interested. I am a buyer of just sufficient odd lots for export to keep in touch with the market and have no interest either in the rise or fall of the price of the red metal. The banks took huge quantities of copper as collateral on loans when metal was worth 18c. per pound. The fact that it can be bought for 13c. today means that the bankers have required further security where this is obtainable and otherwise have insisted on liquidation of stocks.

Buying is extremely slow, both domestic and export. It is the universal expectation that the price will go still lower. Many mines are closing down. Formerly copper wire was sold on a base price, with extras for gage. It is now bought at a flat price. Formerly it was impossible to bargain. At present copper is offered at a surprising number of different prices. Until recently it was possible to arrange to have wire drawn from one's own copper. At present the mills will not do this, though some have such heavy stocks that they quote surprisingly low prices.

There is no demand, little consumption, and not much prospect for immediate increase in the consumption of copper. This means that no one need be in any hurry to buy. It is now possible to buy copper in this market for pounds sterling, francs, kronen, and even marks. Several export houses have built up an interesting though small business in this way. They do not speculate in exchange, but have arranged with banks which require a certain amount of paper regularly. Naturally, the buyer pays a fraction for the quotation in his own money but only sufficient to cover the exchange transaction. It is even done on a sixty-day confirmed letter-of-credit basis, though to only a limited amount, and the interest rate is not low.

We in America are continually hearing threats of Belgian competition in zinc, and recently several small consignments have been imported from that country. We also note heavy reductions of prices of zinc here, of the labor employed and coal consumed in the zinc districts, and, more important, of the demand for zinc. This is all in line with the decreased demand for galvanized products both here and abroad. There are large stocks of zinc and galvanized sheets in various world markets (much of it unpaid for). The largest producers and exporters are of course willing to sell to cash buyers, but the important ones have taken the position lately that it is better to protect their buyers abroad until these have had time to unload stocks on the public without too heavy a loss. This would indicate that though low prices are quoted both from here and Bel-

gium, Eastern and South American buyers are not in the market at any price.

Competition between English and American steel and other metal products will not come for some time. In the meantime we must all sit tight until the consumers get back their confidence to a degree that will warrant new buildings, railroads, and other enterprises.

Lead has slumped in response to the sudden stoppage in new work and the curtailment of output of established old factories. Even the largest producers are not hopeful of higher prices. One important manufacturer of sheet lead says that lead will go no lower and is buying freely for forward delivery but only for a minimum requirement. This is not to be taken too seriously, however, as this particular buyer is frequently on the wrong side of the market. MARK R. LAMB.

New York.

More About Copper Losses in Slags

In *Engineering and Mining Journal* of Jan. 8 Charles G. Maier has commented on my article "Copper Losses in Slags," which appeared in the Dec. 4 number. The five points concerning his silver-nitrate method of determining suspended sulphide copper are not all "objections" to the method—rather they are points on which my findings differed from his. I wish to consider them briefly:

1. Solubility of copper sulphide in silver nitrate. Fused sulphides appear to be almost completely soluble. The incomplete solution of mineral sulphides is not of importance except in indicating that the method is useless when applied to ores.

2. Segregation of dissolved copper sulphide on solidification of slags. A number of the samples I analyzed had been air-cooled, so the opportunity for segregation was particularly good. Less segregation would be expected in granulated samples. However, when the maximum particle of a sample has passed through an opening of 0.0029 in., it is easy to believe that a large portion will be under 0.0010 in., or even 0.0001 in. If so, I believe that much of the copper set free on cooling would be attacked by the silver nitrate.

3 and 4. Solubility of oxidized copper in silver nitrate. The point is that, unless the oxides and silicates of copper are insoluble when free, one cannot be certain that they will be unattacked in the main body of the slag. Mr. Maier is conservative when he says "the method involves *no conclusions* as to the *chemical form* of suspended copper." But if he cannot state the form of the copper dissolved by silver nitrate, is he justified in stating the form of the copper not so dissolved? One would rather expect the reverse to be the case.

5. Effect on metallic iron. As there was no iron in Mr. Maier's samples, it need not be further discussed.

In his criticism of my methods Mr. Maier describes an experiment with copper *sulphate* to show that metallic iron interferes. As there was no copper sulphate in my solutions, this has no bearing on the case. In a solution of copper *sulphite*, metallic iron does not precipitate copper sulphide.

Mr. Maier asks why I did not remove magnetite from my samples. For the double reason that it is both impossible and unnecessary. Many slags containing only a little magnetite are, nevertheless, almost entirely magnetic. And inasmuch as magnetite has no effect on copper sulphide in the presence of sulphurous and hydrofluoric acids, there is no necessity for its removal. Whether its harmlessness is due to reduction by sulphur dioxide or to low dissociation of the ferric fluoride formed is immaterial. I am well aware of the fact that reduction by sulphur dioxide takes place much faster in neutral than in strongly acid solutions.

Calculation of suspended matte from the gold-copper ratios is a method open to criticism, I readily acknowledge, but I believe it to be the best method available. My determinations of gold in slags were made on samples of twenty assay tons each, and the results of these were averaged over long periods of time. I therefore feel that the results calculated from them are of considerable accuracy.

Regarding metallic copper in converter slags, Mr. Maier and I agree that it is usually there, but we differ as to the amount. It is not very soluble in copper sulphide, as shown by the fact that during the final converter blow metallic copper of 98 per cent begins to fall out soon after the matte passes 80 per cent copper. In my article I stated my belief that "the copper soluble in hydrofluoric and sulphurous acids represents closely the total of oxide, silicate and metallic copper in all samples analyzed." As silver nitrate dissolves sulphide and metallic copper, and attacks the oxides (silicates?), it is not strange that the sum of the copper dissolved by the two methods is more than the total copper present. It is my belief that most of the overlapping is due to solution of oxidized copper, but I agree that whatever metallic copper is present is dissolved in both methods.

As for the final statement about the preponderating form of copper in converter slags, I agree with Mr. Maier that what he says is true of many slags—I found such to be the case in my experiments. I would not say, though, that any microscopic method for the quantitative analysis of slag has been well established.

I do not claim that my method of determining oxidized copper in slags is of an accuracy comparable with that of the standard methods of determining total copper. I do believe, however, that it will give a clear idea of the form in which copper is lost in any ordinary slag, and may therefore indicate possible means of saving it.

Deschenes, Que. FRANK E. LATHE.

Stand Tanks and Sand Tanks

I should like to correct an error, typographical or clerical, in my article on "Desert Prospecting" in issue of Oct. 30.

Under the heading "Water Scarce, but Usually Available" reference is made to "open and *stand* tanks." The word "stand" should be "sand." A tank is a collection of water in a depression in the rock as distinguished from a spring. If the water stands as a pool it is an open tank, but if the depression is filled with sand and gravel so that the water is available only by digging it is a sand tank.

Sand tanks are not so convenient as open tanks, nor as easily found, but are preferable, as the water is not as apt to be contaminated as that in the open tank. It is a rule of the desert that when one leaves a sand tank he should fill the hole that he dug to get his water in order to protect the supply from contamination and evaporation.

Referring to my statement regarding animals as water finders, I would say that we located the last sand tank at which I camped where we found a coyote had been digging. LEROY A. PALMER.

San Francisco, Cal.

Rubber in Mine and Mill

Structure of Power Transmission Belting—Formulae for Computing Sizes and Plies of Belting—Bucket-Elevator Belts—Various Sizes and Capacities of Conveyor Belts—Hose Structure—Grades of Rubber

BY A. M. OLIVER
Written for *Engineering and Mining Journal*

CONSIDERING the wide use of rubber in the mining field, it is natural to assume that every mining man has a comparatively thorough knowledge of the subject. But this is not the fact. To be sure, the average mill or mine superintendent has his theories and can in a general way judge the quality of a piece of mechanical goods, but very few superintendents have the requisite knowledge to decide definitely and precisely upon the adaptability of a belt or a piece of hose for the work in hand.

Requests for price quotations received by the manufacturer of mechanical rubber goods from mining men tell the story in no uncertain terms. They show clearly the lack of definite knowledge. The descriptions of the articles on which a price is desired are in most instances entirely inadequate and incomplete. Transmission belting is described as "your best grade 8-in., five-ply rubber belt," or "your best grade conveyor belt, 24 in. wide, ¼ in. thick." I shall endeavor to point out the complete inadequacy of such descriptions.

The fact that these commodities differ widely, not only in quality but in the physical properties of the material used in their manufacture, seems to be overlooked entirely. Take belting, for example. It is generally known that rubber transmission belting is composed principally of cotton duck held together by so-called "friction" rubber and that the cotton duck is folded in the process of manufacture, forming plies. It is assumed that a five-ply belt is stronger than one composed of only four plies. The fact of the matter is that a four-ply belt, under given conditions, may be much stronger than one composed of twice as many plies. To assume that a five-ply rubber belt will transmit so many horsepower is about as logical as to think that a six sixteen-wire cable is twice as strong as one composed of six eight-wire strands. The strength of the cable would depend upon the gage of the wire used. It is the same with belting. The duck from which belting is made varies in "weight" as well as in quality. So does the "friction" rubber with which the plies are treated.

FACTORS DETERMINING STRENGTH OF DUCK

Duck for belting is spoken of as being so many ounces in weight—usually from 20 to 36 oz., with a tensile strength of from 235 to 600 lb. per inch of width. The standard by which the weight is ascertained is a piece of duck 36 x 42 in. This means that a piece of duck 42 in. wide by 36 in. long weighing 20 oz. is called 20-oz. duck; a piece of this size weighing 30 oz., 30-oz. duck, and so on. Needless to say, the 36-oz. duck is much stronger than 20-oz. duck, and a belt made of 36-oz. duck will naturally transmit more power than a 20-oz. duck belt, everything else being equal. But the weight of the duck is not the only indication of strength. Cotton fibre varies in length from one-half to two inches. Long-fibre cotton makes the best duck, and obviously commands a higher price. Even before the cotton reaches the loom, it is put through several operations which have an important bearing on the tensile strength of the finished duck. In the "plaiting" of the cotton, for example, some threads may remain loose, leaving only part of the total number of threads to carry the load. This operation has a definite effect on the quality of the finished product. So it is quite possible to have several pieces of duck, all of 30-oz. construction, yet each piece having a different tensile strength.

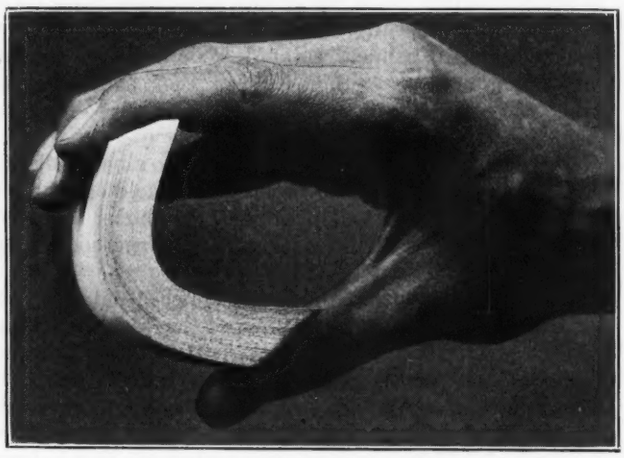


FIG. 1. A PACK OF CARDS BENT TO A RADIUS SERVES TO ILLUSTRATE THE EFFECT UPON THE PLIES OF A BELT WHEN PASSING OVER A PULLEY

A similar story may be told about the "friction" with which the plies are united. This friction is highly adhesive rubber which is forced into every ply of the belt until each ply is thoroughly inpregnated, making the whole a flexible and waterproof body. A good friction means a flexible, permanent bond for the plies, permitting free flexing of the belt around the pulleys, with the least possible generation of heat. Some manufacturers claim a "strong" friction for their belts, and they usually try to prove their point by demonstrating how difficult it is to separate the plies from one another. The fact of the matter is that this so-called "strong" friction is a detriment. It prevents the free flexing of the belt over the pulleys, causing it to generate an excessive amount of heat. As heat deteriorates rubber, ply separation sets in, and when this happens the belt has passed its useful stage. Ply separation, or "bootlegging," as it is commonly called, is caused also by the fact that the attrition between the plies increases as the diameter of the pulley over which the belt passes decreases. The speed of the pulley and the weight of the duck must therefore also be taken into consideration.

In deciding upon the number of plies which may be operated over a pulley of a certain diameter, the weight

of the duck from which the belt is constructed is of prime importance, because the thickness of the duck governs the over-all thickness of the belt. As the belt passes over the pulley, the outer ply must stretch so much more than the inside one that a certain amount of attrition is unavoidable. It is a difficult matter to make a rule governing the number of plies, as all belts differ. However, the following may serve as a guide: A five-ply rubber belt, if made of duck heavier than 30 oz., cannot be operated, in most cases, over a pulley smaller than 12-in. in diameter, unless the pulley travels at a speed of less than 1,000 r.p.m. Belts constructed of lighter duck—28-oz. or less—can be successfully operated over smaller pulleys, provided the friction is of a good grade. I have seen five-ply belts made of 28-oz. duck run over 4-in. pulleys at a very high rate of speed, but of course the friction was of high grade. One cannot go far wrong if one takes into consideration the weight of the duck of which the belt is made, the quality of the friction, the diameter of the pulley, and the speed at which it travels.

Power Transmitted by Belting

The amount of power which a rubber belt is capable of transmitting depends entirely upon the quality and weight of the duck. It is safe to say, however, and it will serve as a guide, that a belt made of a good grade of duck will transmit the following horsepower per inch of width, per ply, when traveling at a speed of 1,000 ft. per min. with an arc of contact of 180 deg.

Weight of Duck in Ounces	Horsepower
36	0.45
32	0.4
30	0.375
28	0.35

To find the number of horsepower that a 12-in., five-ply belt made of 32-oz. duck will transmit at 2,000 ft. per min., the arc of contact being 180 deg., it is necessary to multiply 0.4 by the number 12 (the width of the belt), the result by 5 (the number of the plies), and the product by 2 (double the power transmitted by 1,000 ft. per min.). The answer is 48 hp. Speaking approximately, in 99 per cent of all cases the power a belt will transmit depends on: The speed at which it travels; the tension under which it is placed on the pulleys; and the belt surface in contact with the pulleys.

The speed at which the belt travels governs the amount of power transmitted. If a belt traveling at 500 ft. per min. transmits one horsepower, at 1,000 ft. per min. it will transmit two horsepower; at 1,500 three horsepower, at 2,000 four, and so on. Where the belt reaches a very high velocity, centrifugal force causes a loss of power, but ordinarily this factor may be left out of the calculation. The belt speed may be found by multiplying the diameter of one of the pulleys by its speed and dividing the result by the constant 3.82.

The tension under which a belt is placed on the pulleys, called the initial tension, is the second important factor. It is common practice to cut the belt $\frac{1}{8}$ in. shorter for every foot of its length when applying it. In other words, a belt 30 ft. long would be shortened by $3\frac{3}{4}$ in. (30 x $\frac{1}{8}$ in.). It must be borne in mind that the tension thus obtained constantly decreases in service, and in time will fall below the point at which it will transmit the desired power. It must therefore be retightened at intervals to restore its original tension. The stretch to which a rubber belt is subject varies, and it is not possible to name an average, but it will be found that rubber belting does not stretch nearly as much as most leather belting.

The belt surface in contact with the pulleys is of no less importance. The foregoing table giving the horsepower for the various ducks is based on a pulley contact of 180 deg.; that is, exactly one-half of the smallest pulley over which the belt travels is in contact with the belt. The power transmitted will decrease in proportion to the arc of contact. The loss of power due to a decreased arc of contact is not, however, in exact proportion. Where the angle of the arc of contact is 90 deg., the power transmitted will be 65 per cent of the total at 180 deg. The following table indicates the relation for arcs of contact less than 180 deg.:

Arc of Contact in Degrees	Per Cent	Arc of Contact in Degrees	Per Cent
100	70	150	91
110	75	160	94
120	79	170	97
130	83	180	100
140	87		

The arc of contact may be ascertained by multiplying the difference between the diameter of the two pulleys by 4.775, dividing the result by the distance between the pulley centers in feet, and subtracting the whole from 180 deg. Expressed in equational form:

$$\text{Arc of contact} = 180 \text{ deg.} - \frac{4.775\,(D - d)}{X}$$

D = diameter of large pulley in inches
d = diameter of small pulley in inches
X = distance between pulley centers in feet

How should transmission belt be ordered? How should the mining man know the weight of duck of which each belt is made? How may he ascertain the weight of duck of the belt purchased? There is a logical answer to each of these questions. Present-day merchandising methods are no longer based on "let the buyer beware," but, rather, on "the buyer must be satisfied." Today the manufacturer of belting knows exactly what his product is suited for. He knows or should know how to apply his product to the specified conditions to insure the maximum service to the user. In ordering belt it is therefore best to outline the working conditions to the belt manufacturer, or, better still, ask him to analyze the drive himself, giving you his recommendation of the belt best suited for the work.

Elevator Belts

The fundamental rules for the application of elevator belts are slightly different. The principal thing an elevator is called upon to do is to lift material, often of a very abrasive nature, by means of steel buckets. An elevator belt must first of all have a sufficient number of plies to bear the tension. This tension depends upon the weight lifted, the height to which the material is lifted, and the speed with which it is lifted. To this must be added the weight of one-half of the belt itself and the weight of one-half of the buckets. From the total tension thus obtained the number of plies required can be computed. The power required to lift the load equals tons per hour multiplied by lift in feet divided by 1,000. The actual horsepower which must be transmitted to the belt is from 25 per cent to 100 per cent greater than the above figure, due to the friction of the buckets in passing through the partly filled boot. Where light material is elevated 25 per cent may be enough. On heavy lumpy material such as ore, 50 to 100 per cent must be added.

The horsepower thus obtained is converted into

"pounds pull," as follows: Horsepower multiplied by 33,000 divided by feet per minute (the belt speed in feet per minute). The result is in pounds pull. This is, however, not the total tension on the belt. The total tension to which an elevator belt is subjected is equal to the tension required to lift the load, as established by the foregoing formulæ, plus the weight of one-half the buckets, plus the weight of one-half the belt. The weight of one-half the belt is found as follows: Width of the belt multiplied by number of plies multiplied by 0.04 (a constant) multiplied by distance between pulley centers. Then the number of plies necessary to lift the load is equal to the total tension divided by the

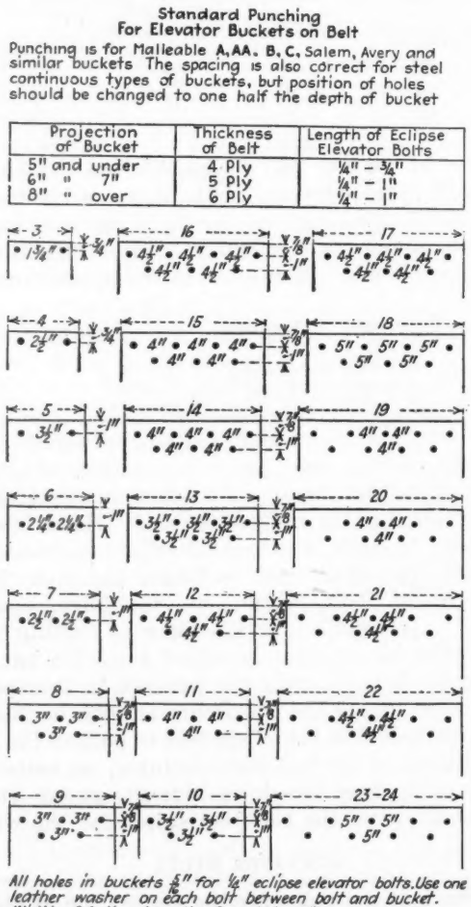

Standard Punching
For Elevator Buckets on Belt
Punching is for Malleable A, AA, B, C, Salem, Avery and similar buckets The spacing is also correct for steel continuous types of buckets, but position of holes should be changed to one half the depth of bucket
Projection of Bucket
Thickness of Belt
Length of Eclipse Elevator Bolts
5" and under 4 Ply 1/4" – 3/4"
6" " 7" 5 Ply 1/4" – 1"
8" " over 6 Ply 1/4" – 1"
All holes in buckets 7/16" for 1/4" eclipse elevator bolts. Use one 1/4" leather washer on each bolt between bolt and bucket.
Width of belt = Length of bucket + 2"

FIG. 2. STANDARD PUNCHING, BUCKET ELEVATOR SET

product of the width of the belt in inches and a factor which equals 29 for 36-oz. duck, 27 for 32-oz. duck, and 28 for 34-oz. duck.

The weight of duck used depends upon the nature of the material elevated. Heavy, lumpy material will be most efficiently handled by a belt made of heavy duck. For light material such as grain a belt made of a lighter duck will suffice.

The width of an elevator belt should be governed by the length of the bucket, that is, the belt should be two inches wider than the bucket is long.

As an example assume 12-in. malleable iron buckets weighing 13 lb. each. The material to be elevated is copper ore consisting of 2-in. lumps, weighing 135 lb. per cubic foot. Assume that the buckets are to be spaced 24 in. apart and that the belt travels 200 ft. per min. and elevates 60 tons per hour to a height of 65 ft., perpendicular. The power required is equal to 60 (ton per hour) multiplied by 65 (lift in feet) which is 3,900, divided by 1,000, equaling 3.9 hp. To this is added 100 per cent for digging in the boot, or 3.9 plus 3.9 equals 7.8 hp. Converting this into "pounds pull": 7.8 (hp.) multiplied by 33,000 equals 257,400 divided by 200 ft. per min. equals 1,287 lb. tension to lift the load. Add to this the weight of half the buckets. There are thirty-three buckets on one-half of the belt. The weight equals 429 lb. The weight of the belt itself is next computed. From the length of the bucket a belt 14 in. wide is needed. Assume that six plies are necessary to do this work. Then the weight of one-half the belt is equal to 14 (the width) multiplied by 6 (the ply) multiplied by .04 (a constant) multiplied by 65 (the lift in feet). This is 218.4 lb. The total tension imposed on the belt is found by adding:

Pounds	
1,287	the tension to lift the load;
429	the weight of half the buckets;
218	the weight of half the belt;
1,934	pounds total tension.

The number of plies required is found by dividing 1,934 by 406, the product of the width of the belt multiplied by the constant 29, thus: 1,934 divided by 29 multiplied by 14 equals 4.7 or five plies.

However, a belt 14-in wide consisting of only five plies would not be very substantial. Experience has shown that a minimum of six plies where the belt is from 10 to 18 in. wide, seven plies where the width is from 20 to 28 in. and eight plies on belts 30 in. and over is good practice.

The spacing of the buckets is from twelve to twenty-four inches, it being generally recognized that there should be sufficient room between them to prevent interference in filling. Twice the depth of the bucket is the usual distance. When the bucket is bolted directly to the belt there is sufficient relative motion between to cause considerable wear. Rubber washers or strips of rubber belting are used to keep them apart and to allow free passage of the sand and grit which otherwise would work in between.

The life of an elevator belt depends upon internal conditions rather than upon the normal stretching and releasing of stress as it picks up and discharges the load and bends over the pulleys. The greatest wear takes place between the belt and the pulleys. Old rubber belting on mill scrap piles will show several plies worn through on the pulley side. It is impossible to prevent the material from getting between the belt and the pulleys. To increase the life of the belt it is equipped with rubber covers, $\frac{1}{16}$, $\frac{3}{32}$ or $\frac{1}{8}$ in. in thickness. The pulley side of the belt has usually a thicker cover than the bucket side, by reason of the greater wear. To decide upon the thickness of the rubber cover to be used, it is necessary to know the "compound" of which the cover is made, its ability to resist abrasion, and other factors. It would be unwise to decide upon the specifications of a belt without knowing its physical properties, as it may develop that the cover will last twice as long as the body of the belt, or vice versa. The secret of economic belt operation is to find a balanced belt; that is, one so constructed that all its ingredients will pass the stage of usefulness at one and the same time. There again, I must point out, the manufacturer of the belt should be allowed to decide the makeup of the belt.

One of the most efficient and economical methods em-

ployed for handling materials in bulk is by belt conveyors, and it is perhaps used more extensively in the mining industry than anywhere else. The installation cost as well as the depreciation on the belt itself, leaving the rest of the equipment out of consideration, is a most appreciable item. The cost of the belt has been found to range from 40 to 60 per cent of the cost of the total equipment, depending upon its width and length. The maintenance charge is estimated to be as high as 33⅓ per cent. Abrasive wear, due to slippage or sliding of the material on the belt, is the chief cause of belt deterioration. As the belt carries its load, a constant readjustment of the lumps takes place, thus gradually wearing out the rubber cover on the belt. Naturally, the property of the carrying surface of the belt, the rubber cover, is an important factor. A belt with a hard, highly vulcanized cover increases the tendency of the material to slide on its surface; one with a comparatively soft and resilient cover is to be preferred. After the cover is exposed to the air for some time it becomes hard if not compounded properly. Cheap belts soon "bloom" after being exposed to the air; that is, the belt assumes a white color, certain ingredients crystallize on its surface, and those remaining form a hard non-resilient mass. The tendency of the cover to harden is somewhat compensated for by the fact that the surface will become rough, allowing a thin layer of the finer material to adhere, which slightly protects the cover.

Where the material must be conveyed on an incline, the abrasive wear is more pronounced, because the material slides back longitudinally. Preventing excessive wear on the belt of an inclined conveyor due to longitudinal sliding of the load can be accomplished only by limiting the angle of incline of the belt to a few degrees below the angle of repose of the material handled.

The wear due to the loading of the conveyor is more difficult to prevent. Neither the wear nor its causes can be entirely overcome, but the destruction can be lessened by proper design of loading chutes and by increasing the area of belt over which the load is distributed. If it were possible to deliver the load in the same direction and at the same speed as the belt travels, no wear would occur at the loading points, but such conditions can be only approximately approached and an oblique impact shock is unavoidable when the load strikes the belt. A resilient cover naturally reduces the destructive action of such impact, and to reduce further the shock with which the material strikes the belt, an adjustable curved plate or lip is often attached to the lower edge of the chute, so that the material leaving the chute is deflected in the general direction in which the belt is moving. The unloading of conveyor belts is often accomplished by means of a tripper, a device consisting of three pulleys so arranged that the belt can be unloaded at any point. These trippers increase the wear on the belt because of the added flexing of the belt around its pulleys, as well as the readjustment of the load while passing over the tripper.

Many factors must be taken into consideration when deciding upon a conveyor belt, and it is impossible to determine the type of belt and the thickness of covers from mere book knowledge. There are no formulæ for calculating the thickness of cover to resist abrasion; this is something which can be determined only from actual experience. The width and number of plies required to carry the load can be ascertained mathematically. The width of the belt depends principally upon the size of lump of which the material consists. Several rules are used by which the width of the belt may be determined. One of these is as follows: Four times the average size piece plus six inches. In other words, if the average lump measures two inches, the belt must be fourteen inches wide. This rule is all right as far as it goes. It must be remembered, however, that the tonnage to be handled, the speed, and other details are deciding factors which govern the dimensions of the belt. The foregoing formula simply marks the minimum width permissible to prevent spilling.

The carrying capacity of belt conveyors is given in Table I.

TABLE I. CAPACITIES AT 100 FT. PER MINUTE OF CONVEYORS HANDLING MATERIAL WEIGHING 100 LB. PER CUBIC FOOT

Flat Conveyor		Troughed Conveyor	
Width, Inches	Tons per Hour	Width, Inches	Tons per Hour
10	7.6	10	17.6
12	10.8	12	25.2
14	14.8	14	34.4
16	19.2	16	44.8
18	24.4	18	56.8
20	30.0	20	70.0
22	36.4	22	84.8
24	43.2	24	100.8
26	50.8	26	118.4
28	58.8	28	137.2
30	67.2	30	157.6
32	76.8	32	179.2
34	86.8	34	202.4
36	97.2	36	226.8
38	108.4	38	252.8
40	120.0	40	280.0

The tonnage a conveyor belt will handle increases in proportion with the speed of the belt and with the weight of the material. That is to say, if a 20-in. belt handles thirty tons per hour of material weighing 100 lb. per cu.ft., the belt traveling 100 ft. per min., it will convey 120 tons per hour if the material handled weighs 200 lb. per cu. ft. and the belt travels at 200 ft. per min.

The power required by a belt conveyor is approximately 2.5 hp. per 100 tons per hour for every 100 ft. of belt. To this must be added the power necessary to lift the material, in case the belt operates on an incline, and the power absorbed by trippers should there be any. The power necessary to lift the load is equal to the tons per hour multiplied by the lift in feet divided by 1,000. The total horsepower thus found multiplied by 1,500, a constant, and the result divided by the product of the width multiplied by the speed, gives the number of plies necessary. Thus: Number of plies equal hp. multiplied by 1,500 divided by width multiplied by ft. per min.

These formulæ are derived from basic principles. Other factors peculiar to each case must be given consideration, but the formulæ will serve as a guide. It is impossible to deal with this subject in its entirety within the limits of this paper.

HOSE

Perhaps nowhere else does hose receive such severe punishment as in the air-drill service in the mine. The continual dragging over extremely sharp ore, the constant vibration, the high pulsating pressure, the oil vapor mixed with the air passing through the hose, combine to make the treatment inflicted extremely severe. A hose for this service must have a tube so compounded that it will resist the action of lubricating oil, which is bound to pass through it from the compressor. In some mines the drills are actually lubricated through the hose, which greatly shortens its life, for oil deteriorates the rubber. It is impossible for the user to test the tube of a hose for oil-resistance except by actual use.

Next in importance is the pressure which the hose must withstand. The air pressure used in most mines ranges from 80 to 130 lb. per sq.in., and the carcass of the hose must be so constructed that it will resist this pressure with the least possible expansion. The tube must be non-porous, so that the air and oil vapor cannot work into the body of the hose. The exterior of the hose must resist the abrasive wear to which it is subjected.

The economical use of air drill hose is by no means the simple problem which some mining men seem to consider it. At least a fundamental knowledge is necessary, and a thorough understanding of the subject will prove an asset. The first thing to be considered is the working pressure to which the hose is subjected. Here it must be remembered that the pressure which a hose will withstand is inversely proportional to its size; that is, as the bore of the hose increases, the pressure which it will stand decreases. A 1-in. six-ply hose may have a bursting pressure as high as 800 lb., whereas a 2-in. six-ply hose made of precisely the same material will burst at 650 lb. Like belting, hose is made of duck varying on weight and in tensile strength. Air-drill hose duck commonly used ranges in weight from 4 to 10 oz. Naturally a five-ply hose made of 4-oz. duck will not stand the pressure that a five-ply hose made of 10-oz. duck is good for. Hose duck is usually cut on the bias, from strips 40 to 42 in. wide, into pieces long enough so that when placed end to end, and lapped, the resulting strip is just wide enough to produce the necessary number of plies. This method makes the finished hose more flexible, and minimizes kinking.

As already mentioned, the pressure a hose will stand is inversely proportional to its size. High-grade hose made of 8-oz. duck will show approximately the bursting pressure given in Table II.

TABLE II. BURSTING PRESSURES OF HIGH-GRADE HOSE

Inches, Diameter	Ply	Bursting Pressure in Pounds per Sq.In.
¾	4	800
1	4	700
¾	5	900
1	5	800
1¼	4	675
1	6	850
1¼	5	775
1½	6	825
1¼	4	650
1¼	5	750
1¼	6	800

Hose made of heavier duck will show a higher bursting pressure, and vice versa. The relation of the working pressure to the bursting pressure should be as one is to five; that is, a hose guaranteed to burst at a pressure of 1,000 lb. per sq.in. should not be used for working pressures above 200 lb. This applies to hose of wrapped-ply construction.

Another method of making hose is the so-called braided or moulded principle. In this construction the carcass consists of layers of cotton cords which are braided about the tube. This construction has the advantage that it can be made in any length up to 500 ft., whereas the maximum length that a wrapped hose can be made is 50 ft. Braided hose is usually made either two or three braid, in sizes ranging from ⅜ to 1 in. A high-grade moulded air hose of three-braid construction has a bursting pressure approximately equal to that of a four-ply wrapped hose. A factor of safety of five should be used.

Air-drill hose has probably to withstand more external wear than hose used for other purposes, and some mining men take it for granted that air-drill hose must be protected by wire winding. It would surprise some of them to learn that the wire which they think protects their hose is responsible for most of their hose troubles. A steel wire wound about the hose forms a non-yielding rigid armor, in contrast to the hose which expands and contracts as the pressure within it rises and falls. When subjected to pressure, expansion is inevitable, but a natural expansion is impossible because of the wire surrounding it. Consequently, internal attrition takes place, the inner tube of the hose separates from the fabric plies, causing a blister which

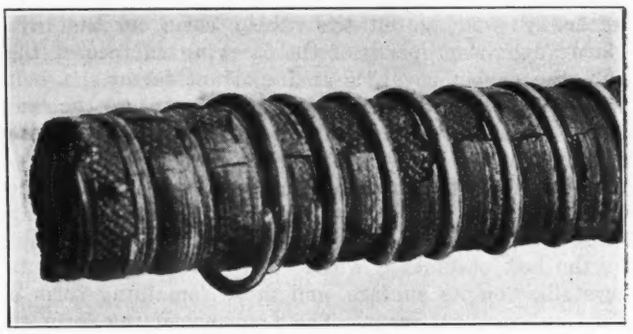


FIG. 3. DISTORTION PRODUCED BY WIRE WINDING WHICH PREVENTS THE FREE EXPANSION OF THE HOSE

sooner or later closes up and prevents air from passing through the hose in the required volume. This is one reason why hose should not be wire-wound. There are many others of equal importance. An examination of wire-wound hose found upon a scrap pile of a mine will show some of the reasons. Perhaps the wire was broken by a falling rock, puncturing the hose, or the wire was bent, closing the passage. Actual experience has proved that a properly constructed air hose will withstand the abrasive wear to which it is subjected better than a wire-wound hose. By a properly constructed hose, I mean a hose with a high-grade rubber cover such as is found on a conveyor belt. This cover resists the cutting action of the ore and allows free expansion and contraction of the hose.

In conclusion, it may be well to say a few words on the subject of rubber. The term "rubber," as commonly employed, does not refer to pure rubber as it comes from the rubber-bearing trees, but rather to a vulcanized compound consisting of gum, mineral matter, and sulphur, mixed in various proportions, according to the purpose for which it is intended. Mineral matter, or "filler," as it is commonly called, serves a useful purpose in adding desirable properties which could not otherwise be obtained. Its presence, therefore, should not be looked upon as an adulteration.

The real value of rubber depends upon the length of time that it will retain those properties which are desirable. Deterioration, as indicated by loss of strength and elasticity, is considered to be the result of oxidation, which action is accelerated by heat and sunlight. Other things being equal, the better grades of rubber possess greater strength and elasticity, and may be stretched to a greater extent than the poorer grades, and they also deteriorate less rapidly. The physical properties of rubber, however, are subject to variation within wide limits, depending upon the proportion of gum present, the materials used as fillers, and the extent of vulcanization.

Iron in Peru

Exploitation of Deposits Practicable on Development of Transportation Facilities Now Under Construction—Fuel and Fluxing Materials and Ferro-Alloys Conveniently Available—Hydro-Electric Possibilities—Government Liberal in Tax Demands and Customs Exemptions

Prepared by Dr. J. J. Bravo, Director of the Corps of Engineers of the Peruvian Government, in June, 1920, and Translated by Charles S. Haley, Major of Engineers, U. S. R., and Associate, Institute of Mining and Metallurgy, London.

Written for *Engineering and Mining Journal*

IN VARIOUS parts of Peru there are deposits of iron, which have been very little studied, and not worked at all, as a consequence of the fact that the general status of this mineral industry in Peru has not aroused interest among private individuals. In recent years the government has made investigations to determine the possibilities and the conditions that commercial exploitation will have to meet. The following deposits have been the subject for these official studies: Tambo Grande, in the Department of Piura, about 5 deg. south latitude; Aija-Callaycancha, in the Department of Ancachs, 9 deg. south latitude; Huacravilca, in the Province of Huancayo, at 12 deg. south latitude; and Marcona, in Ica, at 15 deg. south latitude approximately.

THE TAMBO GRANDE

Examinations have shown that the industrial value of the Tambo Grande deposit is not large. Tambo Grande is situated 106 km. from the harbor of Paita, of which distance 62 km., from Paita to Sullana, is covered by railroad, and the remaining 44 km. must be traversed on muleback, by a level sandy road. The deposit consists of a small mountain, in whose shadow there is a village called Tambo Grande, and which forms a sort of cupola of elliptical base, about 1 km. long and 700 m. wide, with a maximum altitude of 15 to 20 m. above the plain which surrounds it. This mountain is formed by iron mineral, which, as a matter of fact, is nothing else than a conglomerate of rounded quartzite pebbles with a cement of red hematite; and its exposed portion above the plain contains a little more than a million tons.

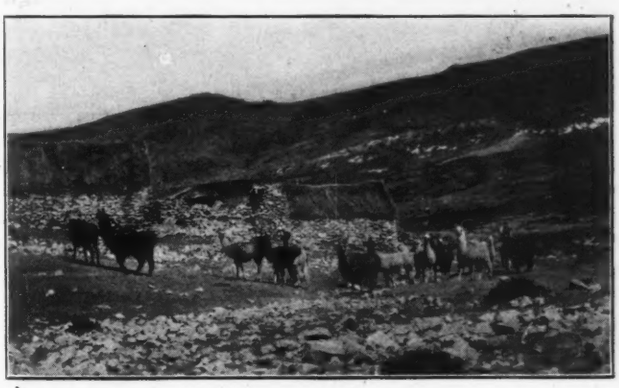
Assays of the pure cement gave 51.5 per cent of iron, 18.5 per cent silica and 0.09 per cent alumina, with traces of oxide of manganese; and indicated absence of sulphur and phosphate. A sample of the conglomerate gave 26.2 per cent of iron and 59.2 per cent of quartz and clay.

In the region there are supplies and resources for subsistance. Lime can be found in the neighborhood of Sullana 10 or 12 km. from the railroad, and, as to fuel, there are known deposits of coal in the hills of La Brea, situated north of Sullana and a little more than 90 km. from this village, the analysis of which has given 67 per cent of fixed carbon, 28 per cent of volatile material, and a little more than 2 per cent of ash; but these deposits are not worked and should be studied before much dependence is placed upon them.

AIJA AND CALLAYCANCHA

The deposits of Aija are situated in the vicinity of the village of this name, and on the western slope of the Andes 100 km. distance from port of Huarmuy. Actually, there is no railroad in this district. It would have to be constructed, and it is estimated that, to reach the mines, it would have an extent of 165 km., of which 108 would be in "slide" country; but there is being constructed a passable road for automobiles which will lead to the mines of Ticapampa, in the District of Recuay, and at the other side of the Cordillera, of which road one part is already finished. This road will pass very close to the mines.

The deposits of Aija consist of various veins of magnetite varying between 0.8 and 2 m., inclosed in walls of slate, sandstone, and quartzite. The mineral contains a small quantity of pyrite, which can be easily separated, leaving the pure magnetite, which gives an analysis of 42 to 70 per cent of iron and 1.73 of silica, the absence of sulphur and phosphoric acid having been proved. There are no deposits of fuel in the neighborhood, but on the other side of the Cordillera in the District of Recuay workable deposits of anthracite of good quality are found, with 86.2 per cent of fixed carbon and 7.9 per cent of ash. As for lime, there is a deposit in the same locality, although data with respect to it are not available.



LLAMA TRAIN

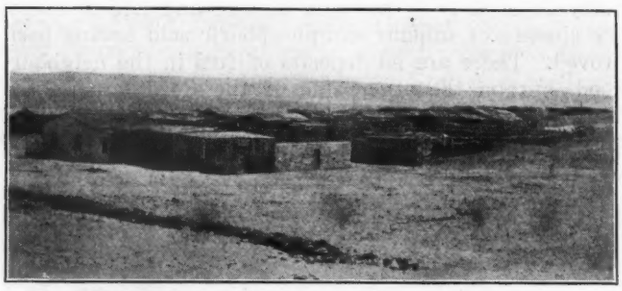
The deposits of Callaycancha are found a little farther north than those of Aija, and in the same situation with regard to the summit line of the Cordillera. Access is gained by way of the port of Casma, from which the deposit is distant 87 km., of which 62 are of road relatively easy and of little difficulty, and the 25 remaining in ground which is very much broken. There is no railroad, and, if one were built, it would have to be approximately 160 km. long, of which only the first 60 would be on level ground.

The deposit consists of three parallel veins, 1 m. 10 cm., 1 m. 50 cm., and 4 m. in width, whose outcrops can be followed for a distance of 600 m. and whose filling is formed by iron oxide. The assays of the mineral have given from 51 per cent to 70 per cent of metallic iron, 19 per cent silica, 0.25 per cent of phosphoric acid, and 0.02 per cent of sulphur. Good anthracite in veins of 1 m. 30 cm. width, with 74 per cent of fixed carbon and 10 per cent ash, is found in Mancos, 35 km. distance from the mine. It is worthy of note

that these veins appear to continue to the Callejon of Huaylas, the valley which lies on the east of the Black Cordillera, which in this place will be at a smaller distance from the coal and from the lime, which are found in abundance in this region; are contiguous to the River Santa, which can supply abundant motor power; and are especially advantageously situated with respect to the railroad of Chimbote and Recuay, whose advanced state of construction leads to the hope that it will soon pass near the deposits.

HUACRAVILCA

The Huacravilca deposit is one of the most important of the country. Huacravilca lies in the Province of Huancayo and at a little distance to the east of the summit of the western Cordillera at the source of the River Mantaro, which waters the important valley of Huancayo. Direct communication with the coast is difficult and long, more than 200 km., but access is more easy by the Central Railway of Peru, which, leaving from Callao, crosses the Cordillera and reaches



PORT OF LOMAS NEAR THE MARCONA DEPOSIT

in Oroya the valley of the Mantaro, which it follows up to Huancayo, from which place, distant from the coast 346 km., up to the deposit, about 80 km. must be traveled by such means as are available, but as the Central Railway is actually in construction, to the south, and as, also, there will have to be constructed a branch to the coal mines of Jatunhuasi, near the deposit, the railroad line which will be necessary to develop it will not need to extend the mentioned 80 km. but only over a length which perhaps will not be more than 25.

The deposit consists of two masses of segregation a short distance apart and separated by a ravine—which deposits are perhaps united underneath the ravine. The outcrops are visible for an extent of 1 km. in length by 200 m. in width in each one of the masses, and the natural cuts permit one to estimate a thickness of 50 m., which would give for the visible part a content which would exceed 60,000,000 tons of mineral.

The mineral, which is sufficiently homogeneous, is composed of red hematite, but contains in some places spots of pyrotite and as a gangue shows fragments of the eruptive acid rock which forms one of its slopes or of the sandstones and quartzites which are found on the other side. Analyses of the numerous samples brought out show a content in iron variable between 66 and 78 per cent; insoluble gangue 2 to 13 per cent; and sulphur 0.06 to 0.07 per cent, although this last, in the parts impregnated with pyrite, nears 9 per cent. Phosphoric acid has never been found in any of the samples. A conservative calculation of the content in metallic iron of the visible part of the deposit, using a figure of 64 per cent, reaches a total of 38,500,000 tons of metal.

The region abounds in lime and dolomite, which can supply the necessary flux, there being extensive bodies of calcareous tuffs of a high grade of purity. There are also sandstones and quartzites, which could be used for silica as well as for material for construction. Clays of various qualities, some of which are refractory, also are found in the immediate vicinity, forming part of an important sedimentary mass which constitutes almost all of the region. The broken topography of the terrain facilitates the access and economic working of these materials.

With respect to fuel, Huacravilca lies in the immediate coal fields of Jatunhuasi, which is one of the most important in Peru. The deposits of coal begin at 10 km. distance from the iron deposit and the outcrops continue for 35 km., representing various formations which appear in many places and whose average thickness may be stated as 60 cm., there being actually at work many mines, which, unfortunately, do not yield all that they might, on account of the difficulty of transport, which would be ameliorated by the construction of the railroad mentioned. The fuel is a fat coal, whose analyses give 54 per cent of fixed carbon, 33 per cent of volatile material, and 11 per cent of ash. The coke which this carbon produces is of good quality and contains 84 per cent carbon and 16 per cent ash, being produced, according to the studies made, at a possible cost of 5 soles ($2.50 gold) per ton at the pit.

Water power can be obtained in almost any quantity, both in the Virgin River, which passes at the foot of the mines, and in the Mantaro, which is not far distant; it having been estimated that the first can be made to generate 2,000 effective horsepower and that the Mantaro can supply almost any amount of power required, as it is a river of large drainage.

With respect to workers and the necessities of life, in the neighboring valley of Huancayo there are plenty of natives who are experienced in mining work, it being possible to easily obtain 2,000 laborers—a number which could be steadily increased—with pay of 50c. to $1 a day, gold, for the day workers and of $1.50 to $2 for mechanics. Foremen and timekeepers can be obtained at a rate of $40 to $60 a month. In the same valley there are abundant farm and cattle resources, for the village of Huancayo is the center of commerce of all the region and the extensive valley which surrounds it. Grain is cultivated in abundance, as in the high pampas of the region there are numerous small farms.

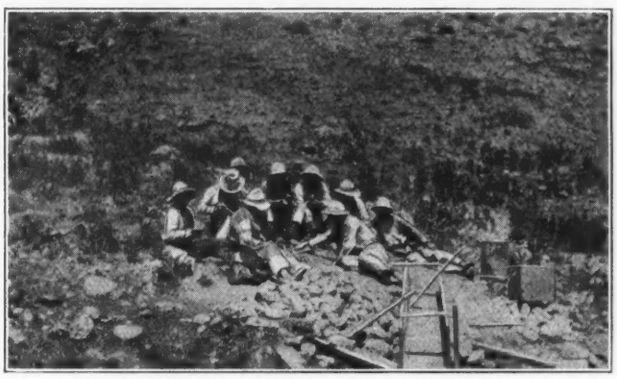
MARCONA

The deposits of Marcona are near the coast, in the dry pampas which extend from the mouth of the River Ica, to the south of the harbor of Pisco, to the harbor of Lomas. It is reached from the first of the harbors named, going by railroad to Ica and afterward to the deposits in automobile in nine hours of travel. Its distance from the port of Lomas, as also from the village of Nazca, situated farther inland, is 60 km., but from the shore of the sea it is only 10 km. distant, being near the bays of San Juan and San Nicolas, which can be used as harbors.

The deposit appears as a series of low hills which rise above the sandy surface of the pampas, and as stains which appear in the middle of the sand, which extend over a surface of a square kilometer and which appear to correspond to an extensive segregated mass inclosed in dioritic rocks, into which it passes gradually upon its edges. An approximate calculation of the quantity of mineral in sight reaches a total of at least 500,000,000

tons. The mineral is a very pure hematite. Analysis of more than twenty samples taken from different localities denoted contents of iron between 60 and 65 per cent; silica 1½ to 11 per cent, the general average being 3 and 4 per cent; phosphorus 0.05 to 0.02 per cent, and sulphur 0.01 to 0.05 per cent, part of the sulphur being found in a state of lime sulphate, which gives rise to the opinion that it is due to a superficial contamination with the lime with which the sands in the vicinity are impregnated.

The deposit offers facilities for exploitation on a large scale and in the open air, and for the convenient transportation of its product, on account of the short distance to the sea. Also, there are in the neighborhood limestones which can be utilized in smelting, but there is no fuel, motor power, or facilities for taking advantage of them, as the region is completely dry and a desert, and the village and cultivated lands that are



PERUVIAN LABORERS HAVING LUNCH OF PARCHED CORN

nearest are 60 km. away. Proximity to the sea can overcome these difficulties, because it would permit the bringing of the necessary resources of life for the working population, and also the necessary fuel for smelting, or, perhaps better, the transportation of the mineral to a region which had better facilities.

Fuel can be brought from the coal fields of Huayday, where extensive exploitation is beginning, embarking it in the harbor of Malabarigo, which has recently been constructed with the development of these mines principally in view. The coal of Huayday is an anthracite of good quality which does not decrepitate and which contains from 83 to 88 per cent of fixed carbon and about 5 per cent of ash.

This deposit, by the good quality of its mineral, by its abundance and by its nearness to the sea, which can supply all the deficiencies of the region, may be considered as the best foundation in Peru for the establishment of the iron industry. The deposit of Huacravilca follows it in importance, and its interest lies in the fact that, being situated upon the trunk line of Peru, which will connect the city of Callao with Lake Titicaca, traversing all the interior of the country, it possesses the advantage of being able to serve the local market and all the Andes region and the neighboring Republic of Bolivia.

The development of the iron industry of Peru is favorably influenced by the existence in the country of deposits of the rare metals vanadium, tungsten, and molybdenum—employed today in the fabrication of special steels—as these metals are found in such abundance as would almost permit the creation of a monopoly.

There is in Peru the most important vanadium deposit in the world. It is at Minasragra, in the Province of Cerro de Pasco, and yields 80 per cent of the world's production. There is also in a large area in the provinces of Pasco, Yauli, and Jauja a series of deposits of vanadium-bearing asphalt which gives an average of 1 per cent vanadium acid, and the ashes of which give a content of more than 50 per cent, according to the proportion in which they appear. An approximate calculation of the quantity of metallic vanadium which could be extracted from this source reaches the enormous figure of 100,000 tons.

MOLYBDENUM AND TUNGSTEN RESOURCES

The most important deposits of molydbenum in Peru now known are found in Ricrin, in the Province of Jauja, 30 km. distance from the city of this name, which is reached by a macadam road which is in poor condition. Some very rich veins are inclosed in granitic rock and with a filling of quartz which contains from 2 to 3 per cent of molybdenite. The mineral is very clean and pure, the climate of the region is cold and raw, and there are abundant workers and all kinds of food resources. Besides, there is molybdenum in Runatuyl, in the same valley of Jauja. It has also been found in many other points in the territory of the republic, but as yet these deposits have not been studied.

The provinces of Pallasca and Santiago de Chuco are separated only by the River Pelegatos, which serves as boundary between them. On both sides of this river are found the most notable deposits of tungsten known in Peru. Access to this region is by way of Salaverry or Chimbote. From Salaverry to the point called Menocucho is 40 km. by rail, and from Menocucho to the deposits is 170 km. of difficult road. The railroad from Chuquicara to Cajamba, which will pass the immediate vicinity of these mines and which will be finished in two or three years, is now under construction. This road will permit the exportation of products of the region by way of Chimbote.

The deposits are of two classes. Some have tungsten and quartz alone and others have it incorporated in a copper matrix. The deposits are very rich. The population of the region is dense, the daily wage is low, and resources of all kinds abound. The average tenor of the ore is about 2 per cent. Also, there have been found deposits of tungsten in the province of Angaraes, in the Department of Huancavelica, and in other parts of the country.

The deposits of coal which are most available and which might yield the necessary fuel for metallurgical treatment have already been mentioned.

There exists in the Cordillera of Peru a tremendous carboniferous zone which extends from the Ecuador boundary on the north to Huancavelica on the south; that is, between 5 deg. and 13 deg. latitude. Over a width varying between 100 and 200 km. there is encountered in all of this region a series of coal deposits, some of which are close enough to the coast to be accessible from that side.

LABOR

The School of Engineers of Lima has turned out many engineers who could be employed in the work of the mines, but there does not exist a personnel capable of directing metallurgical operations. Without doubt, the young engineers are sufficiently prepared to co-operate as aides and to prepare themselves in this manner to

occupy situations of greater importance. The salaries which are paid to engineers, varying naturally with their capacity and experience, can be assumed as between 30 and 100 pounds Peruvian ($150 to $500) monthly.

Mechanics, carpenters, blacksmiths, and other artisans can be readily obtained, and their pay averages from $2 to $4 a day. Experienced miners are found principally in the interior, where the mineral industry is developed, and are paid from 75c to $2 gold a day.

TAXES AND FACILITIES GIVEN BY THE GOVERNMENT

The only tax which actually lies on the iron mines is the mining contribution of three pounds annually per pertenencia of two hectares (about five acres). The law of export duty on minerals expressly excepts the minerals of iron and products of this industry from export duty.

Although there is no law which authorizes the government to provide facilities for those who may establish the steel industry, it is certain that one would be enacted if there were assurances of development and that it would be possible to obtain a great reduction in the taxes imposed on mines, exemption from duty of importations of machinery and materials which are introduced for this object, facilities to obtain under favorable conditions fuel and water-power concessions, and also the right to hold, free of charge, the public lands which might be necessary for the development of the industry, and to expropriate, paying a just price, those which might be private property. Also, it might be possible, in compensation of other facilities, that the government could guarantee the interest and even the amortization of the capital actually invested, and that there might be obtained a customs protection for the products fabricated.

The mineral laws of Peru are very liberal, and permit foreignors to obtain mines, water for motive power, and land for installation on the same conditions as the Peruvians.

Decline in U. S. Quicksilver Production

From July 1 to Sept. 30, 1920, inclusive, 2,045 flasks of quicksilver, of 75 lb. net, was produced in the United States, according to figures obtained from producers by F. L. Ransome, of the U. S. Geological Survey. This is 1,640 flasks less than was produced in the second quarter of 1920. The total production reported for the first three quarters of 1920 is 10,629 flasks, and if the present rapid decline continues, as now appears probable, the total for the year will be less than 12,000 flasks, 9,000 flasks less than that for 1919. The stocks reported unsold at the end of the third quarter were large in proportion to the output, amounting to 3,834 flasks.

Only twelve mines were reported as productive in the third quarter, nine in California, one in Nevada, and two in Texas. California produced 1,356 flasks, Texas 615 flasks, and Nevada 74 flasks.

The average monthly price of quicksilver per flask in New York for the quarter, as quoted in *Engineering and Mining Journal*, was $90.33 in July, $85.36 in August and $75 in September. The average price in the third quarter was $82.66, compared with about $91 in the second quarter. The decline in price was apparently due to a smaller demand for the metal, to the return to the domestic market of quicksilver previously sold abroad, and to the offering for sale of surplus stocks. The poor market, with the continued high cost of labor and supplies, has naturally had a depressing effect upon the quicksilver-mining industry. Two of the most productive mines in California, the New Idria and the Cloverdale, which contributed to the production in the third quarter, are now reported to be idle.

Ontario's Gold and Silver Production Increasing

Ontario's gold output for the first three quarters of the year 1920 was 424,297 fine ounces, worth $8,735,768, an increase of $1,161,182, or 15⅓ per cent, over the corresponding period in 1919, according to the Ontario Department of Mines. During the period, 977,475 tons of ore was milled, distributed as follows: Porcupine, 903,945 tons; Kirkland Lake, 69,328 tons, and miscellaneous, 4,242 tons. As already pointed out, the disabilities under which gold mining has been carried on are gradually being removed, the power situation alone excepted. Details of gold production are presented herewith:

Porcupine		Kirkland Lake	
Hollinger	$4,620,800	Lake Shore	$371,359
McIntyre	1,603,376	Kirkland Lake	215,558
Dome Mines	1,515,086	Teck-Hughes	182,152
Northcrown	70,406		
Porcupine Crown	70,962	Total	$769,069
Dome Lake	46,809	Miscellaneous mines	23,904
Davidson	11,210	Recovery from nickel-copper refining	4,146
Total	$7,938,649		
Grand total			$8,735,768

Miscellaneous mines include the production by Argonaut Gold, Ltd., in the Township of Gauthier; Contact Bay Mines, Ltd., near Dryden, and W. E. Stone, of Mine Centre. In addition to gold output, 71,990 oz. of silver was produced, worth $80,420.

Silver production increased from 7,475,396 to 7,831,132 oz. during the period, as compared with 1919. With the exception of 32,073 oz. recovered from nickel-copper refining and 71.990 oz. from gold-refining operations, the output came from Cobalt, Gowganda, and outlying areas. Power shortage and a rapid decline in the price of silver will have their effect on the output for the last quarter of the year. The average price of silver was $1.33 per fine ounce in January and 94c. for September, with an average of $1.09 for the nine months' period. On Dec. 1 the price dropped to 69¾c. for foreign silver on the New York market. Mines shipping over a half million ounces are given in order: Nipissing, Mining Corporation, O'Brien, Coniagas, and Kerr Lake.

During the period, 426 tons of ore, 2,654 tons of concentrates and 2,117 tons of residues were treated in southern Ontario refineries, for a recovery of 2,406,880 oz. of silver, in addition to arsenic, nickel, cobalt, and compounds of the two last-mentioned metals. A small output at Welland of nickel and cobalt compounds is reported by Ontario Smelters & Refiners, Ltd., successors to Metals Chemical, Ltd. Copper sulphate was marketed to the extent of 98,918 lb., the metallic equivalent being included in the total copper production. Silver producers were paid for 18,202 lb. of copper recovered in United States refineries. A considerable increase is noted in the price of cobalt, but more recently the general slump in prices of metals has seriously affected the business of silver-cobalt refineries. The output of 203,953 lb. of metallic nickel and 20,711 lb. of nickel oxide from silver-cobalt ores is small compared with the product of Canadian nickel-copper refineries.

Selective Converting at Clifton, Ariz.

Advantage Taken of Tendency of Precious Metals To Go Into the Copper Rather Than To Remain in the White Metal—Scheme Applicable Where Gold And Silver Content Is Low

BY J. OWEN AMBLER
Smelter Superintendent, Arizona Copper Co., Clifton, Ariz.
Written for *Engineering and Mining Journal*

THE copper bullion produced from the ores mined by the Arizona Copper Co., Ltd., of Clifton, Ariz., contains so little gold and silver that under normal conditions it is not profitable to refine it. Prior to 1919 it had been sold almost entirely as casting copper, no revenue being derived from the small amounts of gold and silver contained in the bullion. The average analysis of the bullion produced during the last two years was as follows:

	Per Cent, Cu	Ounces per Ton Silver	Gold
Year 1919	99.41	5.357	0.185
January to November, 1920	99.56	4.83	0.150

With silver at $1 per oz., this bullion contains between $8 and $9 in precious metals, and with a refining charge of $25 per ton, it would be necessary to sell electrolytic at about 1c. per lb. above casting, to net the same return to the company. As the normal differential in the price of these two grades of copper is less than this amount, bullion of the analysis given would normally be sold as casting copper, in which case no recovery or payment is made for the gold and silver contained.

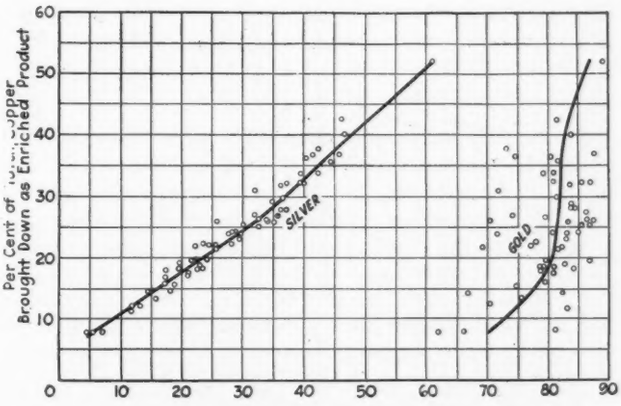
Experiments conducted in 1917 indicated that selective converting was feasible, utilizing the fact that copper has a greater affinity for gold and silver than has white metal. This is simply an adaptation of the old Welsh "best-selecting" process, in which impurities such as arsenic, antimony, bismuth and tin, as well as gold and silver, were collected in a certain small percentage of "bottoms," and "best-selected" copper was made from the remaining white metal free from such impurities. By performing a similar operation in the converter, two grades of copper would be produced—one, enriched in precious metals, to be refined, and the other, correspondingly impoverished, to be sold as casting copper.

To determine what percentage of recovery of the precious metals was possible by this method, a series of experiments was made, using full-size converter charges. The results, shown in the accompanying figure, cover the production of about 650 tons of copper in sixty charges, and show the variation in the recovery of the two precious metals, as the percentage of copper brought down as enriched product varies from 7 to 50 per cent of the total contents of the charges. These results indicate that whereas the silver recovery varies almost exactly according to the amount of copper brought down as enriched, a recovery of approximately 90 per cent of the gold is possible in as little as 7½ per cent of enriched product.

The actual procedure for the production of the two varieties of copper is as follows:

A charge consisting of about fifty tons of matte and the necessary siliceous ore and cleanings is blown in 12-ft. Great Falls type converters, of which four are available in this particular plant, to the white-metal stage as usual. The white metal is then blown until part of it is converted into copper, this blowing time being dependent on the amount of white metal in the charge, the percentage of enriched product desired, and other operating factors. The converter is then turned down, and the overlying white metal is poured off into a ladle. The copper remaining in the converter, which still contains a small amount of white metal and is enriched in gold and silver, is finished and poured as usual, this operation usually taking from three to five minutes, depending on how clean a separation has been made. The white metal which was poured off into the ladle is then poured into the same converter and finished, the copper produced being impoverished in gold and silver.

The principal difficulties encountered in operation



VARIATION IN PRECIOUS-METAL RECOVERY WITH DIFFERENT PERCENTAGES OF COPPER PRESENT IN THE ENRICHED PRODUCT

are to control the percentage of copper produced as "enriched" and to obtain a clean separation when skimming the white metal from the enriched product. As a result of their experience, the operators at the plant can now estimate the percentage of enriched product with a fair degree of accuracy, but the results obtained are still entirely empirical. With a charge containing about fourteen tons of copper in total, the blowing time to produce 55 per cent of enriched product from the white-metal stage averages from fifty to fifty-five minutes under the conditions prevailing in this plant, but this varies with the size of the charge, cleanness of the skim, temperature of the charge, amount of cold scrap fed. temperature of the blast, and other operating conditions, and is still largely a matter of good judgment based on experience. The foremen in charge have developed a scheme for separating the copper and white metal, by observation of the appearance of the molten stream on a rabble blade, which is entirely satisfactory.

Owing to the small or non-existent demand for casting copper during the period of Government control

nothing further was done with the process until 1919, since when, however, it has been used to a large extent for the production of two grades of copper from the ores of this company. The normal production of the Arizona Copper Co., Ltd., since curtailment of operations in 1919 is taken care of by one converter stand, and the percentage of the enriched product to be made is determined entirely by market conditions. Although it would be feasible and profitable to conduct the operation even though there was a sale for all bullion produced as casting copper, in which case not over 10 per cent of enriched product would be made, at present more than half the production is expected to be sold as electrolytic, and the most economical procedure, which is at present in force, is to concentrate all the gold and silver possible in what copper must be refined in any event.

The operating results for a number of months are shown below:

OPERATING RESULTS, ARIZONA COPPER CO., LTD.

Month	Total Tons Bullion	Per Cent Enriched Bullion Produced	Per Cent Total Contained in Enriched Bullion Ag	Au
Feb. to April, 1919	2,667	27.20	40.24	82.47
May	1,216	47.56	62.80	94.56
June	1,557	48.92	62.10	90.96
July	1,087	50.91	62.40	92.22
Sept., 1920	1,220	56.25	65.45	90.47
Nov	1,386	56.92	66.69	92.17
June	1,362	59.93	71.66	92.58
Oct	1,349	62.57	71.39	93.85
April	1,393	65.45	74.03	91.30
May	1,458	65.88	73.78	92.37
March	1,558	67.41	76.14	94.88
July	1,582	70.05	78.28	94.26
Aug	1,661	76.85	83.27	95.10

Since the company's operators have become more skilled in the separation of the copper from the white metal, it is probable that the actual recovery will continue to come closer to the results shown in the cut, even though the plant should produce small percentages of enriched material. However, when running only one converter shell, as at present, a small amount of the enriched copper always remains in the shell when this part of the charge is poured out, and contaminates the impoverished copper that is produced later. It may be possible, when blowing more than one converter shell at a time, to finish each class of copper in a separate shell, in which event, this mixing of the materials after separation will be avoided and the percentage extraction increased.

The cost of the operation at present averages 85c. per ton of total copper produced, the cost including the extra time and incidental expense involved in making the separation, and the cost or re-treatment of additional byproducts produced which would normally be re-treated in the converters themselves, the latter item constituting the larger part of the expense. This figure was obtained by comparing the results noted during the lowest cost month when running straight charges, with an average month when separating the bullion, and is possibly a little higher than an average figure.

On the basis of the experiments made, and on the operating results covering a period of more than a year, it has proved both feasible and economical to conduct the separation as described. The calculation of the maximum profit to be derived under any given selling conditions is simple, and is used to govern the amount of enriched product made at any time. The percentage of enriched copper that is produced may be varied readily without disarranging operating schedules.

The scheme outlined was thought to be new at the time it was initiated. Later, it was found that a similar method had been used at the O.K. Mine, Australia,[1] but as a number of modifications have been introduced, particularly relative to continuity of operation, and as the operators at the Arizona company have had an opportunity to work the process for a longer period under varying operating conditions, the results are of interest. In comparatively few districts in the United States is the precious-metal content of the bullion as low as in the Clifton-Morenci district, but the process has been proved to be applicable, under certain market conditions, to bullions containing very small amounts of gold and silver. An incidental gain is that the impoverished bullion produced is of somewhat better grade in copper than that normally produced, as the small amounts of impurities originally present in the bullion collect in the enriched portion. The impoverished bullion produced in this plant has at times assayed as high as 99.75 per cent copper, and averages above 99.5 per cent.

The successful operation of the process, which still depends to a large extent on the skill of the operators, is due mainly to the interest taken in the matter by the converter organization of the company, of which C. O. Billingsley is general foreman.

Mineral Production of The Pas District

The mineral production of the prairie provinces of Canada, according to Consul General J. G. Foster, shows a falling off in a few minerals required during the war, owing to lack of demand, and in the production of non-war materials the decrease is due to labor difficulties principally. The chief mineral supply of Manitoba lies in the northern part of the province, The Pas being the nearest point having continuous railroad connection with the markets. In 1919 the principal copper production came from the Mandy mine, northwest of The Pas. A total of 3,000,000 lb. of copper was taken out in 1919, as against 2,000,000 lb. in 1918. The metal was derived from about 25,000 tons of ore, containing 18 to 20 per cent copper, 2½ oz. of silver, and one-tenth of an ounce of gold per ton.

The rich ore in the Mandy mine has been exhausted, and operations were curtailed in the latter part of 1919 to await the construction of a railroad or the erection of a smelter in the near vicinity to permit the treatment of low-grade ores. In 1919 the production of gold in Canada amounted to 767,167 oz., of which 611 oz. came from The Pas district of Manitoba. In 1918 Manitoba's output was 1,926 oz. Silver production in Manitoba, in 1919, amounted to 20,760 oz., as against 13,316 oz. in 1918, from The Pas district.

Sulphur in Flotation

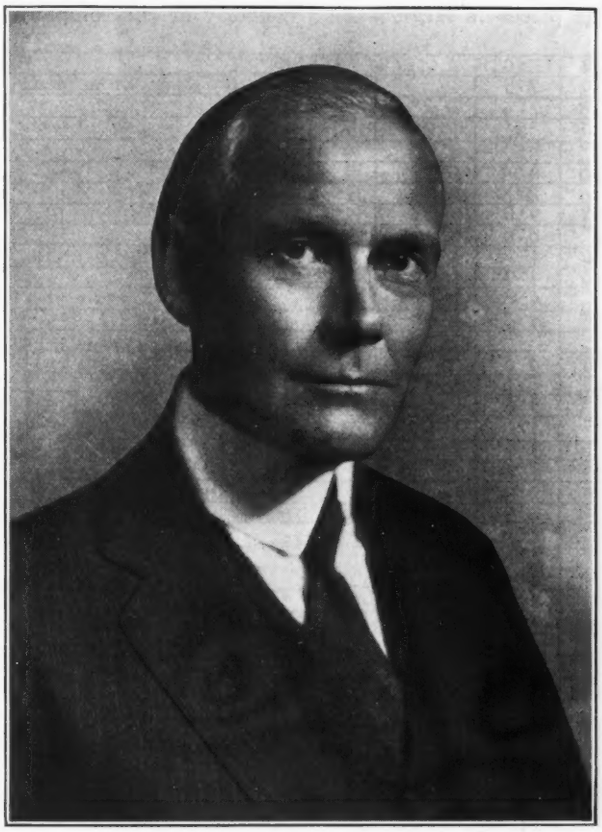
A recent English patent covers the use of elemental sulphur in the flotation of mixed sulphides, the patentees being T. H. Palmer, H. V. Seale, and R. D. Nevett. The sulphur is added in the proportion of one-half of 1 per cent of the weight of the ore, whereby one of the sulphides is removed. Acid or a frothing agent, or both, are then added, and the temperature is raised, under which condition the remainder of the sulphides may be floated.

[1] *Eng. and Min. Journ.*, Feb. 14, 1914.

Mining Engineers of Note

Robert Linton

FROM manufacturer to mine manager is not a long step when one is trained in both pursuits, for both involve the direction of productive industries. Robert Linton, president of the North Butte Mining Co., has made a record in both capacities. After studying at Washington and Jefferson College, and then at the Berlin Polytechnic, in Germany, he started on his engineering career in coal mining work and developing natural-gas properties in western Pennsylvania. This was more than twenty-five years ago. His father had been a prominent glass manufacturer, and it was but natural that the younger Linton, after a few years of mining work, formed a connection in this business and subsequently found himself with the American Window Glass Co. as manager of one of its factories. Eventually he became assistant to the chairman, with general supervision of operations in all the company's plants as well as of engineering work, making his headquarters at Pittsburgh. During this time the American Window Glass Co. developed the blowing machines for making window glass, an achievement that revolutionized the industry in that it substituted a mechanical process for work previously done only by hand and requiring a high degree of skill. Mr. Linton played quite an important part in the work which resulted in the ultimate success of these machines.



ROBERT LINTON

Mining, however, proved the greater attraction, and in 1906 Mr. Linton went back into mining engineering, and, with R. M. Atwater, Jr., and the late M. W. Atwater, formed the firm of Atwater, Linton & Atwater. Since then he has been engaged in mine examination and operation which has covered a wide field in this country and Mexico. When the Sierra Consolidated Mines Co. was organized to operate an important group of silver properties in the State of Chihuahua, Mexico, Mr. Linton was made manager, remaining in active charge until operations were suspended in 1912 owing to political disturbances. He then resumed general practice, with his office in Los Angeles. Early in 1917 he became connected with the North Butte Mining Co., and in the same year with the Consolidated Coppermines Co., of which company he is vice-president and managing director. Since then he has made his headquarters in New York, devoting the greater part of his time to the operation of these companies.

Mr. Linton is the kind of executive who attaches a great deal of importance to the human element in industry, and he has a record of more than usual success in combining efficiency and harmonious team work in the operations under his direction. He has given much study to organization and standardizing of productive operations, both in manufacturing and mining. In a recent paper contributed to the A. I. M. E. he described some new and important work in standardizing underground operations at the mines of the North Butte company, although the credit for this he insists is entirely due to the management and staff in Butte, which planned and carried it out. Operations under Mr. Linton's direction have always been characterized by progressive methods and policy, with occasional departures from the beaten path in search for means of improving results. It was in coal mines, when he was employed as engineer, that electric locomotives were first applied to underground haulage, displacing the more cumbersome tailrope system, and numerous other improvements leading to increased operating efficiency have been due to his suggestions. Keenly interested in the advancement of younger men with whom he is associated or brought in contact, he has found an outlet for such activities in the Y. M. C. A., which has claimed a great deal of his time and his interest for many years.

Mr. Linton is active in the work of the Institute and is chairman of its committee on industrial relations. He has contributed numerous articles to various technical publications, and is on the Library Board of the United Engineering Societies. He has also served as director and chairman of the publication committee of the Engineers' Society of Western Pennsylvania. At the recent convention of the American Mining Congress in Denver he was elected a director of that organization. He is a member of various other technical societies and of numerous clubs, both East and West.

HANDY KNOWLEDGE

Timber Sizes Used by Copper Queen Mine

The needs of a large mine in respect to timber required for supporting underground openings and for underground structures are many. Systematic design and standardization are essential for economy. Nevertheless, the number of different pieces is large, as is shown by the accompanying table, which represents the size of the prepared timber used in the underground operations of the Copper Queen mine, at Bisbee, Ariz. This table was prepared for use in the practical mining course maintained by the Copper Queen mine for its workers at Bisbee, and is here presented through the courtesy of the company.

TIMBER	SIZE	LENGTH	IN CLEAR	TENON	REMARKS
Sq. set posts	10"x10"	7'5"	7'	5"x5"x2½"	Horn both ends
" " "	8"x 8"	7'6"	7'2"	4"x4"x2"	" " "
" " caps	10"x10"	5'	4'7"	5"x5"x2½"	" " " -4'2" between posts
" " "	8"x8"	5'	4'8"	4"x4"x2"	" " " -4'4"
Sill set posts	10"x10"	9'6"	9'3½"	5"x5"x2½"	" one end-
" " "	10"x10"	8'6"	8'3½"	5"x5"x2½"	" " "
" " "	8"x8"	9'6"	9'3½"	4"x4"x2"	" " "
" " "	8"x8"	8'6"	8'3½"	4"x4"x2"	" " "
Ties- 10"x10" set	6"x10"	4'7"	4'2"	Dapped one side both ends 1"x2½" - daps outside	
" 10"x10" "	5"x10"	4'7"	4'2"		
" 8"x8" "	5"x8"	4'8"	4'4"	" " " " " 1"x2" - " "	
" 8"x8" "	4"x8"	4'8"	4'4"		

			CAP		BATTER	
Tunnel posts	10"x10"	8'6"	4'	5'4"	Beveled 1½" one end	17.6"	Caps have a 2"x10"or
" "	10"x10"	7'	3'6"	4'10"	" " " "	14.5"	2"x8" plank nailed
" "	8"x8"	8'6"	4'	5'	" " " "	21.8"	to them 4' or 3'6"
" "	8"x8"	7'	3'6"	4'6"	" " " "	18.0"	in the clear

Long chute posts	10"x10"	9'4"	For 9'6" set - 10"x10" timbers
" " "	8"x8"	8'4"	" 8'6" " - 8"x8" "
Short " "		2'9"	Two posts 8"x8" and 8"x10" for 10"x10" timbers
" " "		2'9"	" " " " " " " " " 8"x8" "
Chute girt	5"x8"	4'2"	For 10"x10" set
" "	5"x8"	4'4"	" 8"x8" "
" sill	8"x8"	4'2"	" 10"x10" " - One edge beveled back 4"- 45 deg. angle
" "	8"x8"	4'4"	" 8"x8" " " " " " " " " " "
Chute lining	2"plank	7'8"	Plank 8", 10" and 12" wide
" jaws	2" x12"	3'8"	Two pieces- 45 deg. bevel each end - measurement long corner
" "	2" x12"	2'6"	" " " " " right and left- " through center
" flooring	2"plank	9'3"	" "
" "	2" "	7'	" "
Timber slide lining	1"x12"	7'8"	
Cribbing-wall plate	8"x8"	10'8½"	Dapped one side both ends and center 1½"x8" -2cc 4'4" sq.
" end "	8"x8"	5'8"	" " " " " 1½"x8"
" wall "	5"x8"	10'	" " " " " and " 1½"x5"- 2cc 4'4½" sq.
" end "	5"x8"	5'	" " " " " 1½"x3½"
Spiling	4"x6"	8'	One end beveled 4" in 6"
Foot-blocks	4"x10"	20"	
Drift braces	4"x6"	4'2"	For 10"x10" sets
" "	4"x4"	4'4"	" 8"x8" "
Flooring	2"&4"	5'	10" and 12" wide
Matting	2"	8'	10" " 12" "
Stringers			5"x8"x8'&12'- 8"x8" & 10"x10"x11'
Split lagging		5'	Usually longer
Track ties		3'6"	4"x6" and 5"x8" motor drift
" "		3'	4"x4" ordinary drift
Ladders	2"x4"	12'	Rungs 1"x2½"x14"-12"centers -dapped ¼"x 2½"
Blocks and Wedges			Various lengths

TIMBER SIZES USED IN COPPER QUEEN MINE

Auxiliary Centrifugal Pumps Underground

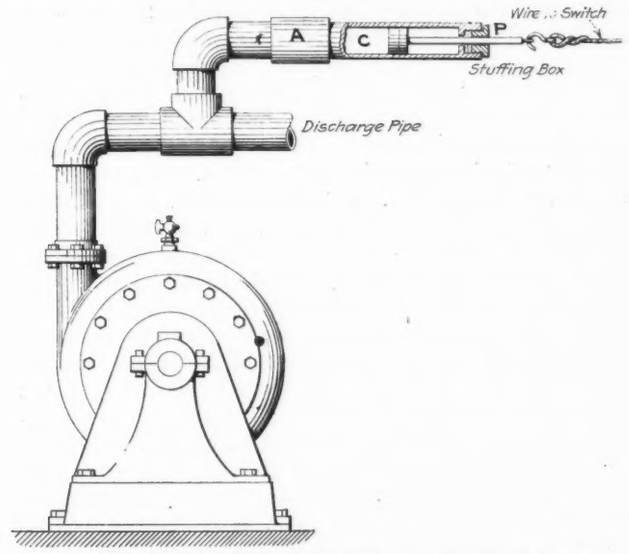
BY WILLIAM F. BOERICKE
Written for *Engineering and Mining Journal*

It is often necessary to install small centrifugal pumps underground where the "bottom" takes a sudden dip downward, allowing the water to collect over the haulage tracks unless conducted to a sump. These sumps are generally of small capacity, and it is usually cheaper, where electric current is available, to install a pump and motor and pump the water over the hump to the main pumping station, rather than to excavate dead bottom, or even to ditch the water if the distance is appreciable. Although a pump is a constant expense, on account of the power, unless a ditch has a good grade the sediment from dirty mine water will settle in it and gradually fill it up, necessitating a labor charge to clean it out at not infrequent intervals.

The pump installation should be as nearly "fool-proof" as possible and should require no labor attendance except to start it when the sump is full. An automatic device should be installed to cut out the power and stop the

pump when the sump is empty. Here the pumpman has a chance to exercise his ingenuity. The simplest method is, of course, to put a float in the sump. The float is connected by a wire to the switch, and its movement down stops the motor. By properly adjusting the length of the wire, the sump need not be drained dry and there will be no need of priming the pump when it is started again, if it has a tight check valve on the suction pipe.

The method, however, is limited to those conditions under which the pump and motor are situated directly above the sump. It may happen that it is more convenient to have the pump and motor some distance away from the sump, with a long suction pipe running thereto. In that event another device can be used. The accompanying figure shows a satisfactory arrangement. The old pump cylinder *C* was threaded and screwed into the nipple *A*. When the pump was throwing water the pressure forced out the piston *P* to the end of the cylinder. The wire to the switch was then hooked onto the piston end. When the sump was empty and the pump started to run dry, the air pressure forced the

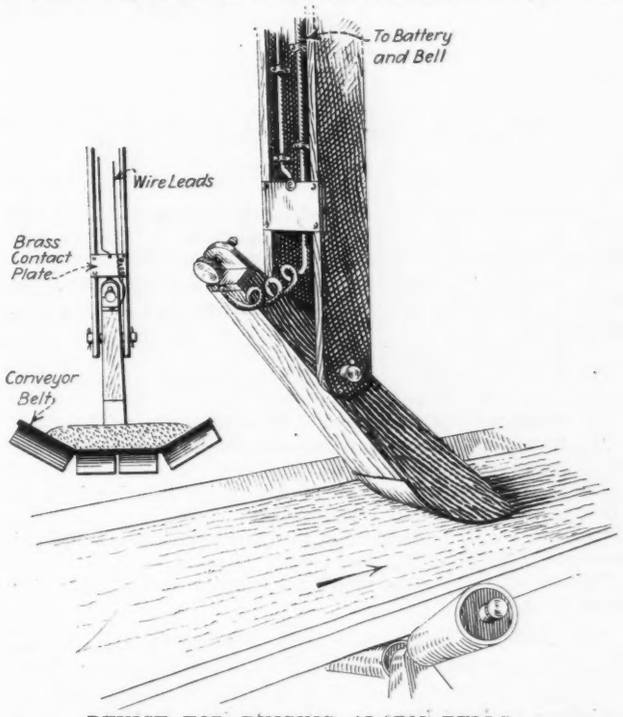


DEVICE FOR STOPPING PUMP AUTOMATICALLY

piston back, and this pulled the switch with it. This scheme worked satisfactorily, but it was necessary to spend a few minutes in priming the pump each time that it was started.

Alarm Bell for Belt Conveyor

At the plant of the Tintic Milling Co. at Silver City, Utah, an ingenious device has been arranged to indicate by the sounding of an alarm bell the discontinuance of the stream of material upon a moving conveyor belt. At this plant the finely crushed ore is fed from different bins upon belt conveyors which discharge upon another conveyor. This in time discharges into a bucket elevator and this into a bin. It is necessary to mix the ores in definite proportions, depending upon the respective analyses, together with a fixed proportion of finely pulverized coal. This is done by regulating the feeder streams from the various bins. As long as the flow of material continues the final mixture will approximately reach the desired proportions. An interruption of any one feed stream would interfere with the proper mixture. The device is a short block of wood pivoted above its center of gravity. On the end is a simple electrical contact that completes an electrical circuit when the end of the block resting upon the ore stream falls, due to the absence of material. By means



DEVICE FOR RINGING ALARM BELLS

of an adjustible brass bolt the device can be regulated so as to give an alarm when the depth of material upon the conveyor belt changes even slightly. T. P. Holt, superintendent of the plant, states that the device serves its purpose exceedingly well.

Oxy-Acetylene and Electric Arc Welding In Dredge Repair Plants

In the second annual report of the Canadian Klondyke Mining Co., Ltd., and the Canadian Klondyke Power Co., Ltd., attention is called to the value of oxy-acetylene and arc welding equipment, installed at a cost of $17,766. An additional arc welding unit of 1,000 ampere capacity was added to the repair equipment, at a cost of between $7,000 and $8,000. One of the major pieces of work accomplished by the oxy-acetylene and arc welding appliances was the reclamation from junk piles and scrap heaps of 68 buckets of 17-cu.ft. capacity which enabled an additional dredge to be operated. There were but few failures of the reclaimed buckets, and such as developed from time to time were replaced by other reclaimed buckets.

A large number of bucket pins were reclaimed by building up worn pins. Other worn parts offered opportunities for building up. By placing the welding equipment on the dredge considerable expense was saved by obviating the necessity for the removal of tumblers, plates, and other parts. On the hydro-electric pumping plant the failure of an important valve was remedied by putting an expansion joint in the pipe at a point near the pumping station to take care of the expansion and contraction in the pipe which had caused the failure of the valve. The valve was repaired and the expansion joint installed by the aid of the welding crew in forty-eight hours.

CONSULTATION

How Federal Reserve Notes Are Issued

"I presume there are a great many people who, like myself, are hazy about the modus operandi of the Federal Reserve banks. Will you kindly answer the following:

"1. Is there any limit in law as to the amount of Federal Reserve notes that can be issued? How are they put into circulation?

"2. How are they retired?

"3. Federal Reserve notes say they pay on demand, but do not say with what they will pay.

"4. What kind of collateral is back of the notes?

"5. In what way are they superior to the greenbacks that were issued after the Civil War?

"6. Is it not true that greenbacks were inferior in purchasing power to gold and silver?

"7. Are we not steered for the rocks with an unlimited issuance of Federal Reserve notes?

"These are questions which have agitated my mind for some time."

*1. Federal Reserve notes come into circulation chiefly in two ways: (a) Banks may bring other kinds of money into the Federal Reserve banks and take in exchange Federal Reserve notes. This was the case, for example, in 1917, when the banks, in order to centralize the country's gold reserves where they would be of the most service, deposited large amounts of gold and gold certificates in the Federal Reserve banks, the place of which in the country's stock of money was filled later by Federal Reserve notes. (b) Member banks rediscount their customers' paper with a Federal Reserve bank or borrow on their own notes from it, receiving primarily a credit in their deposit account. But they may draw on this account and receive Federal Reserve notes, if desired. The paper which they leave with the reserve banks becomes collateral for the Federal Reserve notes, as noted again below.

2. The chief way in which these notes are retired is through a reversal of the above process. Since the only legal reserve of a member bank is its balance with its Federal Reserve bank, it is not good business policy for it to keep more notes in its vaults than are needed for ordinary business. Any excess will be paid to the Federal Reserve bank to reduce its borrowings. In other words, notes not needed by the business of a community will find their way into the commercial banks and thence into the Federal Reserve banks and will be retired.

The Federal Reserve board has the right to reject in whole or in part the application of any Federal Reserve bank for these notes. Other limits imposed are, the amount of commercial paper offered to the Federal Reserve banks and the gold reserve requirement, as will be seen from the answer to the question 4.

3. The law provides that reserve notes shall be redeemed in gold on demand at the United States Treasury Department or in gold or lawful money at any Federal Reserve bank. A statement to this effect will be found upon the back of each note.

4. The collateral security behind the notes consists of gold and gold certificates to the amount of at least 40 per cent and the other 60 per cent drafts, notes, and bills of exchange which the Reserve banks have discounted for member banks, those banks' own notes, and bankers' acceptances bought in the open market. In order to be eligible for rediscount, commercial paper must be drawn for agricultural, industrial, or commercial purposes, and not for investment purposes nor for the purpose of carrying or trading in stocks and bonds. (except United States Government securities). Such paper must also have a maturity at time of discount of not more than ninety days, except in the case of agricultural or livestock paper, which may run not over six months. Promissory notes of member banks must have a maturity not exceeding fifteen days. Thus the intent of the law is that these notes should at all times have behind them dollar for dollar gold or liquid paper growing out of commercial transactions. As a matter of fact, there was on Dec. 30, 1920, one-sixth more eligible paper behind these notes than was required, besides 50.5 per cent gold, after setting aside the reserves required against net deposits. Federal Reserve notes are obligations of the Government, and, further, are, together with Federal Reserve *bank* notes, "a first and paramount lien on all the assets" of the issuing banks.

5, 6, 7. The greenbacks were mere promises of the Government to pay on demand unsupported by monetary reserve or collateral. Consequently, they fluctuated in their purchasing power or their relative value to gold according to the public estimate of the Government's present or future ability to pay. With the country involved in a war of which the outcome was often highly doubtful, every unfortunate event lessened public confidence in the country's credit and currency. Further, every increase in the amount of this currency decreased its value by making its repayment more doubtful or more remote. These were defects inherent in the nature of the greenbacks which made them inferior to such a currency as the Federal Reserve notes. In addition, the banking system of that day was inadequate to the strain, and specie payment was suspended for eighteen years (1861-1879). In contrast to that condition has been the generally strong position of our banks during the recent war, for which much credit it due to the system of central banking inaugurated with the Federal Reserve. It is generally recognized that it was most fortunate for the United States that the Federal Reserve system was organized in time to function during the war. It is expected that there will be an orderly deflation, during which the liquidation of loans at commercial banks will allow them to decrease their borrowings and their deposits with the Federal Reserve banks; also to return for retirement a large amount of Federal Reserve notes. The result will be a considerable increase in the percentage of the gold reserve to the notes.

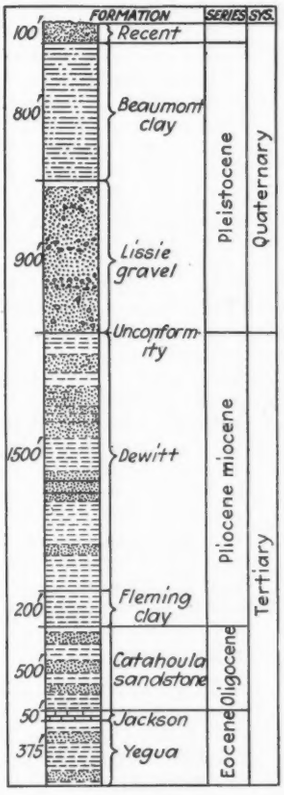
*This information was courteously supplied by the Federal Reserve Bank of New York, to whom grateful acknowledgment is hereby made.

THE PETROLEUM INDUSTRY

Condition of the Spindletop Oil Field

BY F. J. S. SUR
Written for *Engineering and Mining Journal*

ON Jan. 7, 1901, Captain Lucas brought in the famous Lucas gusher in the Spindletop field. That production was not measured, but Captain Lucas and others gaged the output to be about 75,000 bbl. daily. Well after well was brought in thereafter almost daily, some of which produced as high as 96,000 bbl. a day. No field was ever so intensively drilled as



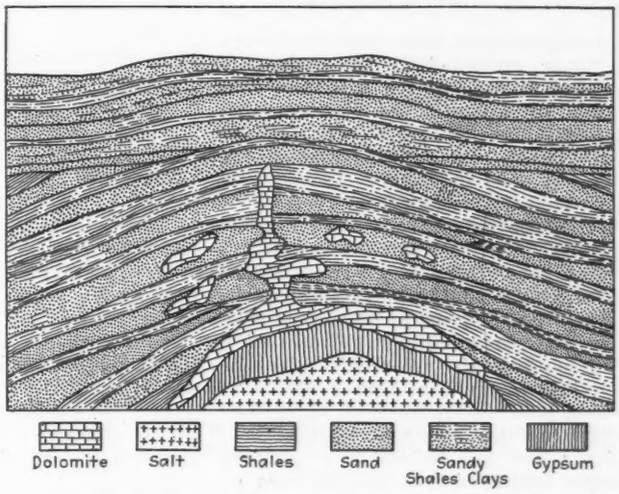
GENERALIZED COLUMNAR SECTION IN THE SPINDLETOP FIELD

was Spindletop, a total of 1,003 wells having been driven within an area of 144 acres. Lots that measured 32 ft. x 80 ft. sold for as high as $100,000. No attention was paid to side-line boundaries, and the rigs were braced against each other, so that visitors could walk 500 ft. in one direction by merely stepping from derrick floor to derrick floor.

A 9 ft. x 12 ft. holding was owned by a man named Mead. When he had placed his derrick floor it occupied land that was owned by five separate companies. This was in the northwest corner of the Lone Acre property. His well made 23,000 bbl. daily initial production.

Recently when I visited the old field, there were 130 derricks in place and 100 wells were producing a total of 1,000 bbl. daily.

S. B. Eddy, one of the last of the "old guard," is still drilling wells there. The data which he gave me are extremely interesting, and I have since proved the authenticity of the record. He has four wells averaging 10 bbl. daily now producing. Thirty-five wells have, up to date, been drilled in nineteen years on the Lone Acre, and all produced oil in commercial quantities. A year ago a well drilled on this property produced 125 bbl. daily for two months, and it is still producing 10 bbl. daily. Four wells are being drilled in the field all the time. It seems to be the only oil field that replenishes itself.



VERTICAL SECTION THROUGH A GULF COAST SALT DOME

Costs at present, compared with those of the old days of 1901, are interesting. The old wells took from six to nine months to drill, and costs were as high as $40,000 per well. Today, wells are being drilled in from fifteen to twenty-one days' time, at a complete cost of $4,000.

The price obtained from the oil in the old days was 10c. per barrel, and this is now $2.50 per barrel. The gravity of the oil is 22½ Bé. The shallowest producing well was 730 ft. and the deepest was 2,950 ft. The great production was from the top of the Salt Dome, and the deep well struck 125 bbl. in the Fleming formation on the west side of the dome.

All rigs used in the Spindletop field are of the rotary type. It was in this field that this particular type of rig originated, and it was evolved because of the fact that the use of the cable-tool type took so much time and entailed such a great cost to drill through the thick sand body. In the first producing well, the Lucas well, 373 ft. of sand was encountered in the first 598 ft. drilled. The derricks average from sixty-four to eighty-five feet high, with bases twenty feet square.

Technical Papers

Relief Map of the U. S.—The U. S. Geological Survey, Washington, D. C., has recently issued a new relief map of the United States, copies of which are available on request to the Director for 75c. each. The map measures 40 x 70 in., the scale being fifty miles to the inch. It is printed in brown and blue, and is a fine specimen of lithography. It makes an excellent wall map for home or office, as it indicates the state lines and principal cities, as well as making it easy to visualize the topography of the country.

Treating Complex Ore—A short review of an investigation into the low-grade complex-ore industry of Colorado is contained in U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,206, obtainable on request. A more complete account will be published as Bulletin 10 of the Colorado Bureau of Mines, and may be obtained by addressing Horace E. Lunt, State Museum Building, Denver, Col.

Iron and Steel Industry of India—In a paper presented at the eighteenth general meeting of the American Iron and Steel Institute, New York, on Oct. 22, 1920, Charles P. Perin has outlined the history and development of the iron and steel industry of India. It is estimated that Indian iron-ore reserves total 20,000 million tons of high-grade material, with fuel within 500 miles at the maximum, and at an average distance of 120 to 130 miles. There are also large deposits of dolomite, coal, manganese, magnesite, and wolframite. The paper deals principally with the activities of the Tata Iron & Steel Co., whose present development plans contemplate a total tonnage of 700,000 tons of pig iron and 580,000 tons of steel ingots converted into 425,700 tons of various finished products.

Potash From Alunite—"The Extraction of Potash From Low-Grade Alunite" from Marysvale district, Utah, is the title of Bulletin No. 13, obtainable on request from University of Utah, School of Mines, Salt Lake City, Utah. Potash has been produced from alunite commercially since 1915. The ore, containing approximately 10 per cent K_2O, is crushed, roasted in a pulverized-coal-fired cement kiln and leached with hot water. The residue is filter-pressed and stored for possible later recovery of alumina. The solution is evaporated and the K_2SO_4 crystals are dried, pulverized, screened and sacked. The bulletin describes experiments on ores containing 5 to 7 per cent K_2O.

Storage-Battery Locomotives—Technical Paper 264 of the U. S. Bureau of Mines discusses the use of storage-battery locomotives in mines containing combustible gas. Price 10c. from the Superintendent of Documents, Washington, D. C.

Copper in South Australia—The Wallaroo and Moonta Mining & Smelting Co., Ltd., Wallaroo, South Australia, has issued an attractive sixty-nine-page illustrated book in sepia, describing the works of that company. Copper sulphide ore is mined, most of it being concentrated by hand picking, Hancock jigs and flotation. At the smelter roasting is carried on in sintering pots and in pyrite burners, the gas being used for acid manufacture. There is one ten-foot blast furnace, two acid converter stands and a small reverberatory. Gold and silver are concentrated in the converters in the "copper bottoms," probably in the same manner as has been done at the Arizona Copper Co. smelter. Electrolytic refining is practiced, and there is also a leaching and precipitation plant. Most of the information given is general in character.

Iron Ore—"Tapping the Nation's Great Reserves of Lean Iron Ores" is the title of an article by A. J. Hain which appears in the Jan. 6 issue of *The Iron Trade Review* (Cleveland, Ohio; price, $1). A description of the plant and operations of the East Mesabi Iron Co. at Babbitt, Minn., is given. This company will mine and treat the low-grade magnetic iron ores of the Eastern Mesabi range and has already made excellent strides in the construction of the plant, which is to cost approximately $60,000,000.

Sand and Gravel—"Sand and Gravel in 1919," a thirteen-page section of "Mineral Resources," has just been published by the U. S. Geological Survey and may be obtained on application.

Mine Fires—Brief suggestions on preventing fires in metal mines are given in U. S. Bureau of Mines *Reports of Investigations* No. 2,194. (Free from the Bureau at Washington).

Manitoba Minerals—A fifty-five-page book, entitled "Mineral Prospects in Southeastern Manitoba," has just been issued. Among others, the gold deposits of Rice Lake and Gold Lake are described. Copies may be had on application to the Publicity Commissioner, Parliament Buildings, Winnipeg, Man., Canada.

Potash—"Potash in 1919," a twenty-page section of "Mineral Resources of the United States," has just been issued by the U. S. Geological Survey, Washington, D. C. (free). A bibliography of recent articles on potash and its extraction is included.

Mississippi Road-Making Materials—This subject is covered in a 139-page book issued as Bulletin No. 16 by the Mississippi Geological Survey, Jackson, Miss. (free).

Lead—"Lead in 1918," a thirty-four-page section of "Mineral Resources," has just been published by the U. S. Geological Survey and may be obtained on application.

Book Reviews

The Geology of the Gisborne and Whatatutu Subdivisions. Raukumara Division. By J. Henderson and M. Ongley Wellington. New Zealand Department of Mines: Geological Survey Branch. Bull. No. 21. (New Series); pp. 88; 1920.

This bulletin embodies the results of a geological survey of certain squares or arbitrary subdivisions embracing about 1,100 square miles situated on and near the New Zealand coast. The rocks of the region are, besides some probably Cretaceous, mainly Tertiary, followed by Pleistocene, and make up a sedimentary series about 10,000 ft. thick. A number of separate formations are distinguished, usually separated one from another by marked unconformities. There are no solid igneous rocks in the district, but repeated layers of pumice and other volcanic aërial or submarine detritus occur in the series. Pleistocene elevation and depression, as shown by raised shore benches and other criteria, were repeated and covered a vertical range of hundreds of feet. An extension system of block faulting cuts all the rocks.

The region is of chief economic interest because of the indications of oil, which include actual oil-seepages. These have been known for a long time, and many attempts have been made to find oil in commercial quantities, but all have been unsuccessful. Many previous writers have described synclines and anticlines in the rocks, but the present writers conclude that the many changes of strike and dip of the beds are due to block faulting. The numerous faults in the Gisborne district are regarded as unfavorable for the occurrence of large oil pools. Specific suggestions for further exploration are given, the chief of which is to avoid drilling within the great fracture belts. J. E. S.

Pumping by Compressed Air. By Edmund M. Ivens. Second edition; Cloth; 6 x 9¼; pp. 266; illustrated. John Wiley & Sons, New York. Price, $4.

This edition has been slightly revised and contains several pages of additional text, together with formulæ and tables. The author has succeeded in making an excellent selection of material, and the arrangement is such that the book constitutes a valuable reference work for the student and those who are considering construction requiring the installation or use of compressed-air pumping machinery. Liberal references are made to the technical press, and the features of operating plants in various fields are described, some of them in detail. Mr. Ivens has included considerable data which he collected during the installation and testing of air lifts under a wide range of conditions.

D. E. A. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Bureau of Mines Issues Three New Cinematograph Stories

Asbestos and Sulphur Traced Graphically From Vein to Consumer's Hand—Ingot Iron Also Depicted

Two new educational motion picture films of the mining industry, "The Story of Asbestos" and "The Story of Sulphur," were ready for public distribution by the Bureau of Mines about Feb. 1.

"The Story of Asbestos," in six reels, was produced by the Bureau of Mines in co-operation with the H. W. Johns-Manville Co. This series illustrates in detail the methods employed in the mining of asbestos in Arizona and in Quebec, and also shows the manufacturing processes used at the Johns-Manville Co.'s plants in New Jersey and New Hampshire.

"The Story of Sulphur" was produced by the Bureau of Mines in co-operation with the Texas Gulf Sulphur Co. and shows in detail the methods of production, storage and transportation employed at the plant of this company at Gulf, Tex.

The Bureau of Mines has in preparation a film on the production of ingot iron, which is being made in co-operation with the American Rolling Mill Co. and soon will be completed.

These three films will have their first public showing at the meeting of the American Institute of Mining & Metallurgical Engineers in New York on Feb. 16. Inquiries in regard to the lending of these films for educational purposes should be addressed to the Pittsburgh station of the U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

Report on First Aid and Rescue Classes in Globe-Miami District Shows Year's Growth

The Globe-Miami Rescue and First Aid Association, with its rescue station at Globe, Ariz., has for members the following seven companies: Inspiration Consolidated Copper, International Smelting, Miami Copper, Old Dominion, Iron Cap Copper, Arizona Commercial Mining and Superior & Boston Copper. The partial report of the association's work for December and the summary of training for the year 1920 reveal a healthy activity in this important work of training men in first-aid and mine rescue work. During 1920 the 220 first-aid classes had an attendance of over 4,000, there being 905 men receiving training in this branch. As the result, 251 men earned and received district first-aid buttons, and 245 men secured Bureau of Mines first-aid certificates.

The district "button" men now number 329.

The classes in mine rescue work showed an attendance of 734, there being 124 men under training, and an average attendance of over five men at each practice. By the end of the year seventy-one Bureau of Mines rescue work certificates had been earned and were awarded.

In addition to these training classes there were many inspections of first-aid boxes, supply bases, pulmotors, and other rescue apparatus distributed throughout the district. Perhaps the inspectors' activities find best expression in the annual mileage of the three motor cars in that service. These cars had a total average travel of over 700 miles monthly, and covered 19,306 miles in all during the year ending Dec. 31, 1920. The director, Orr Woodburn, says in his letter of transmittal recently received:

"Two calls to mine fires were answered during the year. One proved to be a false alarm and the other was out on arrival. Numerous incipient fires have been extinguished with facilities at hand, which demonstrates the possibility of fire and the advantage of extinguishers.

"It is worthy of note that a greater number of employees could be given first-aid training with the same time, effort and expense.

"The contest plan is progressing nicely. Some of the large departments are not yet represented by contesting teams."

Rocks Under Great Pressures To Be Studied at Madison, Wis.

W. A. Clark Presents Press and Thermometric Equipment for Experiments in Metamorphism

By the aid of funds given by W. A. Clark, of Butte, Mont., the geologic department of the University of Wisconsin at Madison, Wis., has acquired a compression testing machine capable of exerting a pressure of 400,000 lb. The university will use the machine in studying various problems in structural and metamorphic geology involving the behavior of rocks under pressures similar to the great pressures experienced in nature by the rocks of the earth and other planets.

The machine is equipped to maintain automatically a constant pressure over a long period of time. Means for heating the materials while under pressure, and for maintaining them at a constant temperature, as well as for accurately measuring the temperatures they undergo, also will be provided. The pressure is developed by an oil-operated hydraulic press.

Brazilian Consular Invoice May Not Carry Abbreviations

Many Consignees Pay Fines Because American Houses Forget This Rule—Tax Taker Profits

As a result of the failure of American shippers to comply fully with regulations regarding Brazilian consular invoices, receivers of American goods at Brazilian ports are frequently subjected to fines and put to considerable trouble. This matter has been called to the attention of the Chamber of Commerce of the United States in a communication just received from the American Chamber of Commerce at São Paulo, Brazil.

The São Paulo chamber points out the necessity of giving complete information called for in each separate column of the Brazilian invoice form, specifying that the use of abbreviations results in a fine being imposed on the consignee. The letter reads:

"Consignors of merchandise are failing to write out the country of origin of the goods and the country where the goods are purchased in full, in each of the columns provided for that purpose on the consular invoice, and are abbreviating along the top of each column the name of the country of origin, 'United States of America' or 'Estados Unidos da America,' to 'U.S.A.' or 'E. U. da A,' placing these initials across the two columns in question.

"This abbreviation is used of course, for convenience sake, but the consignees in Brazilian ports, on dispatching their goods, are fined because of such abbreviation.

"We might also call your attention to the fact that the custom-house officials discharging the goods receive 50 per cent of the fine levied on consignees taking their wares from the custom house, which fact encourages the fine for the slightest deviation from the Brazilian consular invoice regulations."

Prof. Leonard Hill's kata-thermometer, which was invented to measure the cooling effect of the air surrounding the human body, is being introduced into the mines of South Africa, according to a paper recently presented by H. J. Ireland before the Chemical, Metallurgical and Mining Society of South Africa. The remarks on it made by A. J. Orenstein show that this instrument has a number of points of superiority over the usual mine anemometer. The instrument is new to mining men both here and abroad.

The Engineers' Club of Northern Minnesota held its regular meeting on Jan. 29, at the Mohami Club, Virginia, Minn. Ward Royce spoke on the use of underground loaders and slushers.

PERSONALS

R. P. Luke, mining engineer, who has been in Mexico during the last year, has returned to New York City.

Philip N. Moore recently addressed the Ohio Engineering Society on "The Engineer and a National Board of Public Works."

W. M. Tappan, of Hibbing, Minn., general superintendent of the Oliver Iron Mining Co. in the Hibbing district, is on an extended pleasure trip to California.

John H. Kennedy, of Buffalo, N. Y., superintendent of furnaces for the Rogers Brown Ore Co., was in Hibbing about Jan. 15 conferring with the officials of his company.

Joseph Houston, formerly manager of the Dome Mines, Porcupine, Ont., and more recently connected with the Orr mine of Kirkland Lake, is examining mining properties in Mexico.

Dwight Woodbridge recently made an examination of the Rowe mine, the Cuyuna Range property upon which lease has lately been surrendered by the Pittsburgh Steel Ore Co.

Theodore Pilger, mining engineer, formerly in Butte, Mont., and in Alaska, has accepted a position in the New York City sales office of the Allis-Chalmers Manufacturing Co., 50 Church St.

Walter A. Funk, mining engineer, has gone from Idaho Springs, Col., to Iola, Kan., where he will be engaged in oil geology work with Dr. H. B. Patton. His address is now Iola, Kan.

H. V. Hansell, of Hamilton & Hansell, Stockholm, Sweden, and New York, investigated the magnetic separation plant of the Mesabi Iron Co. on the eastern Mesabi Range during the week of Jan. 10.

E. E. Berliner and **S. F. McElroy** have severed their connection with the Michigan Smelting & Refining Co., Detroit, Mich., and have formed Berliner-McElroy & Co. at 1111 Superior Viaduct, Cleveland, Ohio.

E. W. Wagy, superintendent of the Bureau of Mines petroleum experiment station at Bartlesville, Okla., recently resigned to accept the position of production engineer with the Standard Oil Co. of California.

W. P. Wolff, who has been associated with the Oliver Iron Mining Co. at Ely, Minn., for the last two years, has been appointed chief engineer of the Vermilion district for the same company. Mr. Wolff formerly was chief engineer for the M. A. Hanna Ore Co., Crystal Falls, Mich.

M. J. Kirwan, recently in Japan for a year with the Nippon Oil Co., has been assigned to charge of drilling and production work of the Bureau of Mines petroleum station at Bartlesville, Okla. Mr. Kirwan was formerly state oil and gas supervisor for the California State Mining Bureau.

S. R. Smith, who has been superintendent for the Ahmeek Mining Co. for a number of years, has resigned. He is succeeded by **Ocha Potter,** formerly superintendent for the Superior Copper Co. and efficiency engineer for the Calumet & Hecla Mining Co. and its subsidiary mines.

Charles H. Claypool and **J. L. Sullivan,** of Hibbing, Minn.; **James Hildebrand,** of Biwabik, Minn.; **Thomas Mulvaney,** of Crosby, Minn., and **J. R. Boase,** of Duluth, Minn., are making an inspection of various furnaces in Chicago and Sharon, Ill., Youngstown and Cleveland, Ohio, and elsewhere.

Miss Addie Hughes is the new clerk of the House Committee on Mines and Mining. Miss Hughes is a native of

Harris & Ewing
MISS ADDIE HUGHES

southeastern Missouri, where she acquired a considerable knowledge of the manner in which certain phases of the mining industry are conducted. Since her appointment to the clerkship of the committee, she has been acquainting herself with the history of the activity in war minerals and the legislation which grew out of it. She also is familiarizing herself with other phases of mining legislation soon to come before the committee.

H. H. Hill, assistant superintendent of the Bureau of Mines petroleum experiment station at Bartlesville, Okla., who has been with the bureau several years as chemist and specialist in refinery engineering, was appointed superintendent of the Bartlesville station on Jan. 1, vice E. W. Wagy, resigned.

Harold A. Linke mining engineer, recently of Salt Lake City, Utah, has accepted the appointment as chief field engineer on construction work, including mills, plants, and tramways, for Cia. de Real del Monte y Pachuca, Hidalgo, Mexico. He left Salt Lake City on Jan. 27, for his new field, and his family will join him there in April.

Clyde A. Heller, of Philadelphia, Pa., president of the Tonopah Belmont Development Co., recently spent several days in Tonopah inspecting the Belmont mine. It is authentically reported that Mr. Heller is to take the place of **George Wingfield,** who is resigning, on the board of directors of the Tonopah Divide Co., at the annual meeting of the company on March 2.

SOCIETY MEETINGS ANNOUNCED

The Canadian Institute of Mining and Metallurgy will hold its annual general meeting in the Chateau Laurier at Ottawa, Ont., on March 2, 3 and 4, 1921. The secretary-treasurer is G. C. Mackenzie, 503 Drummond Building, Montreal, Que.

The national council of **American Society of Mechanical Engineers** will convene at Syracuse, N. Y., on Feb. 15, instead of on the 12th, as previously announced. The newly elected president of the society, Edwin S. Carman, of Cleveland, Ohio, will preside.

American Engineering Council of F. A. E. S. will meet at Syracuse, N. Y., on Feb. 14, instead of on the 11th, as previously announced. The principal speaker will be President Hoover of the F. A. E. S., who outlines the council's plan for dealing with industrial relations and human waste as affecting the present host of unemployed.

OBITUARY

Benjamin Bowden Lawrence, consulting mining engineer, of New York City, died there on Jan. 21, after a short illness, at the age of sixty-three. Mr. Lawrence was graduated from the Columbia University School of Mines in 1878, and early took up mining in Gilpin and Summit counties, Col. After a few years he opened a consulting office in Denver, Col., and had carried on consulting work ever since. Some years ago Mr. Lawrence returned to his native state and began consulting practice in New York City. At this time he became interested in Cuban copper properties and in the gold fields of eastern Oregon. He became a director in the Horn Silver Mining, the Utah Metal & Tunnel, and the Cornucopia Mines companies of Oregon as well as a number of others. In 1909 Columbia University conferred on him the honorary degree of master of science, and several years ago he was elected a trustee of that university. Mr. Lawrence was a member of the A. I. M. E. and of the Mining and Metallurgical Society of America.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Conkling - Coalition Lawsuit Involves Interesting Point

Do Monuments or Wording of Patent Define Claim?—Case Before Supreme Court

The litigation between the Silver King Coalition and the Conkling mining companies, of Park City, Utah, now drawing to a close, arguments having been concluded on Jan. 19 in the appeal of the former before the U. S. Supreme Court, brings up the interesting point as to whether a mining claim is defined by the wording of the patent issued by the Government or by the monuments on the ground. The case involves the ownership of ore alleged to have been taken out by the Coalition from the Conkling claim jointly owned by the two companies (three-quarters by the Conkling and one-quarter by the Coalition). The Conkling claim is defined in the patent as having a length of 1,500 ft., whereas as set forth by the attorneys for the Coalition, it is officially surveyed and monumented as being 1,364 ft. in length. The Coalition maintains that practically all of the ore mined was taken from beneath the surface of the 135½-ft. strip forming the difference between the length of the claim as monumented and as given in the patent issued and that the disputed strip belonged to itself, having been acquired by transfer from the Belmont mining company prior to the extraction of any ore; also the Coalition claims the ore as being on the Crescent fissure which apexes on adjoining claims owned by it.

When suit was brought by the Conkling company before the trial court in Salt Lake City, Judge John A. Marshall presiding, decision was rendered in favor of the Coalition. The circuit court of appeals, upon the appeal by the Conkling, reversed this decision and awarded the Conkling a judgment for $570,000. Then followed the appeal by the Silver King Coalition to the U. S. Supreme Court, the arguments in which have just been concluded. The Conkling company takes the view that the boundaries of the Conkling claim are, until altered by a decree of court, as set forth in the Land Office patent, and denies the claim of the Coalition to the ores through the Crescent fissure system. The decision of the Supreme Court is awaited with much interest both in regard to the possible establishment of a ruling or precedent for the definition of claims when future controversies arise and on account of the large sum involved.

WEEKLY RÉSUMÉ

With the exception of the U. S. Steel Corporation's subsidiary, the Oliver Iron Mining Co., all operators on the Lake Superior iron ranges have reduced wages 15 per cent. In Minnesota a proposal to put state mineral lands on the market has been made, and plans for leasing are being worked out. The Chateaugay Ore & Iron Co., in New York, has shut down owing to the depression in the iron industry. Three lawsuits involving mining property have drawn attention recently: The Rico Consolidated Mining Co., at Rico, Col., has won its apex suit from the Rico Argentine Mining Co. Arguments were concluded last month in the Conkling-Silver King Coalition case, in Utah, and the decision is awaited with interest. In the case of the Bluestone Mining & Milling Co., in Nevada, the recent demurrer was overruled by the court. The Western Pacific Railroad Co. has cut its freight rate on ore to Utah smelters and other roads have followed suit. In Mexico, the government has appointed a commission to inquire into the cause of the failure of the Xotol dam at Pachuca last month.

Cleveland-Cliffs Iron Co. Reduces Wages 15 Per Cent

The Cleveland-Cliffs Iron Co. reduced wages 15 per cent, effective Feb. 1. This reduction will effect the following mines on the Mesabi Range: The Meadow-Fowler at Aurora, the Wade-Helmer at Kinney, the Boeing mine at Hibbing, the Crosby mine at Nashwauk, and the Hill-Trumble mine at Marble.

Blue-Sky Law Substitute Drawn in Northwest

The Northwest Mining Association, with headquarters at Spokane, Wash., has directed the preparation of a "proposed Washington Securities Act." It is planned to present this to the Legislature as a substitute for the so-called "blue-sky" law now up for consideration. Its sponsors say that if enacted into law it will afford protection to the investor without injuring legitimate constructive effort. The measure is to be laid before the eastern Washington delegation.

Minnesota Mineral Lands May Be Put on Market

Senate Interim Commission Formulates Plans for Leasing of State-Owned Iron and Peat Areas

Findings of a special interim commission of the Minnesota Senate appointed two years ago to investigate facts relating to deposits of iron and peat on lands owned by the state were presented to the Senate Jan 26. The State of Minnesota owns many thousands of acres of so-called school and swamp lands on the iron ranges and peat areas of the northern part of the state, upon little of which extensive exploration or development has been done.

The commission recommends that an extensive soil and geological survey be made at once and formulates a complete mineral-leasing bill which it believes will effect speedy and proper exploration, leasing and development of these lands. The report is signed by Senators F. E. Putnam, J. D. Sullivan, George N. Sullivan, Ole Sagang and A. J. Rockne.

As regards the probable iron-bearing lands the principal recommendations of the committee are:

1. That such lands should be classified into the following divisions: Lands likely to have direct shipping ore; lands likely to have ores of a wash character, lands containing magnetite ores needing beneficiation, and land containing iron ores or ore material where a combination of two or more of the foregoing processes may be necessary.

2. That all permits for leasing of mineral lands be put up at public sales by the state auditor at specified intervals.

3. Prospective mineral lands should be divided into units not to exceed two government subdivisions per claim, aggregating eighty acres.

4. Bids to be on the amount of royalty per ton per claim above the minima set out in the lease law.

5. That there should be a prospecting permit good for one year with a fee of perhaps $50, providing for regular assessment work, reports to the auditor and the splitting with the state of every sample taken in exploration work.

6. The lease should run for fifty years, with provisions, in addition to the usual requirements, for (a) furnishing full plans for opening and operating the mines, (b) reserving to the state use of the surface except that

portion reasonably necessary in the work of operating such mines, (c) a royalty payment on the iron content of the crude ore, designating a basis for determination of the grade of the crude ore, but leaving the details to be worked out between the operator and the state auditor so as to meet the varying conditions at the several mines, (d) a minimum annual output sufficiently large to encourage operations and discourage holding the property as a reserve, and yet small enough to permit the operator to suspend operations during poor market times without endangering his lease; the royalty paid when no ore was removed to be considered as advance royalty, provided the excess ore was shipped within a period of three or five years, and (e) all assignments of interest in such leases to be filed for record with the state auditor.

Merger of United Silver Copper With Copper King Proposed

Plans for the consolidation of the United Silver Copper Mining Co. and the Copper King Mining Co., which own contiguous claims near Chewelah, forty-three miles north of Spokane, Wash., on the basis of an issue of 1,800,000 shares of new stock at a par value of 25c. per share, were presented to stockholders of the United Silver company at a meeting held recently. The United company has been in operation the last fifteen years, and has produced $2,000,000 in silver and copper ore and paid $140,000 in dividends. It is incorporated for $1,000,000. The Copper King has a large deposit of low-grade copper ore.

Northwest Lead Co. Opens Office in Spokane

The Northwest Lead Co., of Seattle, Wash., in which the Bunker Hill & Sullivan Mining Co. recently acquired a heavy interest, has opened offices in the Paulsen Building, Spokane, Wash., which it will occupy jointly with the Bunker Hill & Sullivan Co.

Frank Smith, smelter director of the Bunker Hill company, is vice-president of the lead company. The latter company, the interests of which Mr. Smith will look after in this territory, uses Bunker Hill & Sullivan pig lead and manufactures a wide variety of lead products.

Western Pacific Cuts Freight to Utah Smelters

The Western Pacific Railroad Co. has announced a general reduction in rates on ore from all points in Nevada on its line to the Utah smelters. Other lines also have announced reductions. Specific points were given in traffic bulletin No. 11 on ore from East Ely, where a reduction of $1.75 a ton was named; from Lane, $1.72½ per ton, and from Ruth and Kimberley, $1.70 per ton, all on shipments moving to Murray, Utah.

Rico Apex Suit in Colorado Decided

Court Finds in Favor of Rico Argentine Co., Plaintiff

The case of Rico Consolidated Mining Co. vs. Rico Argentine Mining Co., an apex suit for the recovery of ore alleged to have been removed from the plaintiff's territory, has been decided in favor of the plaintiff. Judge W. N. Searcy, of the Sixth Judicial District Court of Colorado, held that the trespass was not willful. Damages were awarded amounting to $29,946 against the Rico Argentine Mining Co. and $7,346 against the Marmatite Mining & Milling Co., lessee of the defendant. The judgment represents the net value of about 5,000 tons of ore. The decision is based on the assumption that the ore deposits in controversy were formed by east-west fissures rather than by the Blackhawk fissure, thus reversing theories held by mining men regarding the geology of the camp. The decision may affect claims held by other companies operating in the neighborhood.

Northern Pacific, Great Northern and Oregon-Washington railroads lowered freight rates Feb. 1 on low-grade ores from the Cœur d'Alenes district, Idaho. The action was taken voluntarily by the railway lines, and follows similar action in Montana.

Dolly Varden Holds Up Silver Output of Province

New Power Plant Almost Ready—Development of Wolf Group Planned

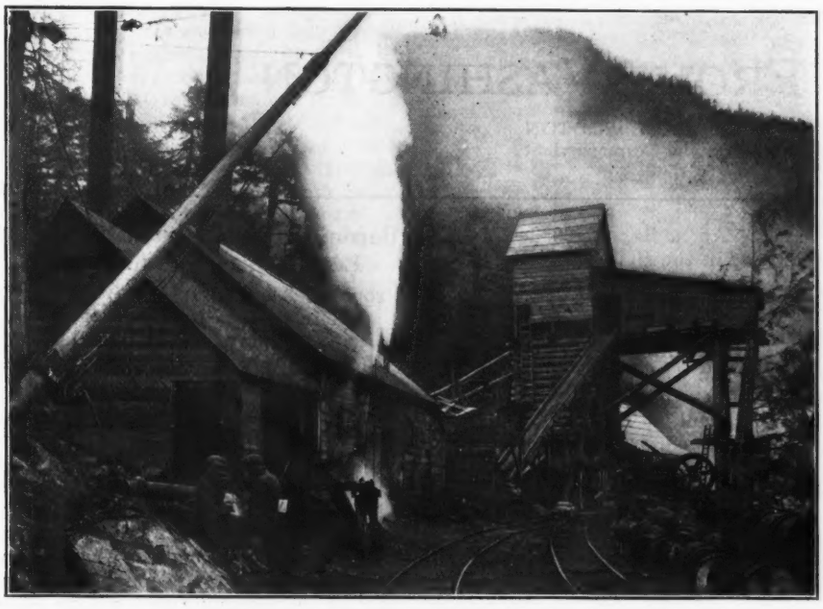
BY ROBERT DUNN

Contrary to general expectations, and notwithstanding the comparative inactivity of the Slocan mining camps during 1920 owing to labor trouble, the official estimate of the mineral production of British Columbia for the last year indicates that there will be a slight increase in the output of silver.

UPPER TRAMWAY TERMINAL AT DOLLY VARDEN MINE, BRITISH COLUMBIA

In 1919 there was a production of 3,403,119 oz., valued at $3,592,673, and the 1920 production is placed at 3,404,926 oz., with a value of $3,265,324. It will be noted that the fall in the price has affected the valuation materially.

One of the chief reasons for this is the production of the Dolly Varden mine at Alice Arm. This property produced 1,170,000 oz. of silver from Sept. 1, 1919, to Sept. 30, 1920. From the time the management secured its staff, technical and non-technical, and got its plant in first-class running order, until about a month ago, operations have proceeded continuously at a pace that taxed facilities almost to capacity. Because of the exigencies of the winter it has been necessary to close down the property, but it is expected that work will be resumed on the same scale as heretofore as soon as weather permits.



COMPRESSOR BUILDING AND LOWER TRAMWAY TERMINAL AT DOLLY VARDEN MINE, BRITISH COLUMBIA

The railway from Alice Arm at the seaboard to the Dolly Varden mine is now complete. A. J. T. Taylor, managing director, has announced that the certificate of approval for operation has been granted by the Minister of Railways.

From the same source comes the information that three orebodies have been discovered on the No. 5 tunnel level, which is 230 ft. vertically below the lowest present workings, and that another orebody has been found on a continuation of the workings up the hill, 200 ft. distant from the highest upper workings.

It is planned to drive a lower tunnel from the railway level, which will be known as No. 6, and which is about 340 ft. vertically below No. 5. The management expects to be shipping from these lower levels next season.

As to development, it is stated that about 1,500 ft. of tunneling will be done at the Wolf mine, situated a short distance north of the Dolly Varden and on the Kitsault River. This is expected to prove up a large tonnage of shipping ore. A 500-hp. hydro-electric plant is almost ready for operation, and with its completion the properties will be fully equipped.

Branch of Zinc Institute Chooses President

Past Year Successful for Organization in Spite of Market Conditions

A. M. Gaines, general manager of the Kanok Metal Co. in the Joplin district, was elected president of the Tri-State branch of the American Zinc Institute at a meeting of the directors held Jan. 25. H. T. Hornsby and Lee L. Fillius, manager of the Anna Beaver Mining Co., were named vice-presidents and Richard Jenkins was chosen secretary-treasurer.

Mr. Gains succeeds F. C. Wallower, manager of the Golden Rod M. & S. Co., who was offered the honor of succeeding himself but declined. Under Mr. Wallower's leadership the organization has enjoyed a successful year, and, despite the slump in the zinc-mining industry, is considered stronger now than at any time in the past. Through its roads department it has collected and spent during the year an average of not far from $2,000 a month toward road maintenance in the district, and it also has continued its financial support for the continued operation of the Picher Hospital, which otherwise would have been closed.

Mr. Gaines, one of the popular operators of the field, who has taken a deep interest in the Tri-State organization since it was started, was formally inducted into office on Jan. 26.

Overrule Demurrer in Bluestone Lawsuit

In the suit of Martin J. Heller vs. Joseph R. Delamar, in which the property of the Bluestone Mining & Smelting Co., at Yerington, Nev., is involved, Judge Moran, of Reno, has handed down a decision overruling a demurrer on all grounds with the exception of a subdivision of one section in the complaint which was stricken out on motion. The suit is for $300,000, which Heller claims is his share of the Bluestone property under an agreement entered into by himself and Delamar when the company was organized, whereby he, Heller, was to receive one-twentieth interest in each claim and 5 per cent of the capital stock. In addition to the 5 per cent interest in the property, which Heller says is worth $6,000,000, he claims 5 per cent of all the profits since 1905. The Bluestone Mining & Smelting Co. was made defendant on the death of Delamar.

Northwestern Smelters Shipping Metal via Panama Canal

Five hundred tons of Montana copper and 1,000 tons of pig lead from the Cœur d'Alene district, Idaho, were loaded last week in Seattle for shipment to New York via the Panama Canal. Several shipments of copper have already passed through the port of Seattle, but this is the initial shipment of pig lead from the Bunker Hill Smelter at Kellogg, Idaho.

It was recently announced at Butte by the Copper Export Association that plans had been made to ship metal to England via Tacoma and Panama. It is said that this will be slightly cheaper than shipping to Eastern seaboard.

Kennecott produced 10,599,480 lb. copper in December (including Braden's output), as against 11,146,000 in November.

PORTAL OF NO. 5 TUNNEL, DOLLY VARDEN MINE, BRITISH COLUMBIA

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Little Hope for Further Relief Legislation

War Mineral Awards Recommended During Week Over $50,000—Justinicum Case Reconsidered

Practically no chance remains of liberalizing the War Minerals Relief Act at this session of Congress. It is doubtful if the incoming Congress would authorize legislation broadening the existing statute. The bare possibility exists of securing action on the Senate bill, which allows an appeal to the Court of Claims and to the U. S. Supreme Court. That bill has passed the Senate and has been reported favorably by the House Committee on Mines and Mining.

Awards aggregating $50,348.03 were recommended by the War Minerals Relief Commission during the week ended Jan. 22. The awards were as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed are shown): W. Bulakn, chrome, $160, 26 per cent; Ashby, Long, Staples & West, manganese, $1,596.39, 26 per cent; Philipsburg-Chicago Manganese Syndicate, manganese, $2,853.65, 47 per cent; A. E. Westover, chrome, $1,156.66, 30 per cent. In addition, a number of claims were reconsidered and awards made. In the case of the Kromore Co. $2,645.50 was awarded Aug. 7. An additional $973.82 is now allowed. In the claim of B. Muscatelli, which had been disallowed, an award of $111.43, or 13 per cent of the amount claimed, was recommended. The Needles Mining Co. was awarded $4,561.66 on Oct. 27. An additional $4,446.92 now has been awarded. The claim of Paul J. Harding, which had been disallowed, was reconsidered and an award of $213.14 was recommended. This is 1 per cent of the amount claimed. The claim of the Cia. Minera de Justinicum, S. A., was disallowed Sept. 29, 1919. On reconsideration an award of $38,836.02 was recommended. This was 39 per cent of the amount claimed.

Tariff on Limestone Proposed in Amendment

Limestone and lime products are deemed by Senator Jones, of Washington, to be the proper subjects of emergency tariff legislation. He has introduced an amendment to the Emergency Tariff bill providing the following duties: Lime in cooperage, 50c. per 100 lb., gross weight; lime in bulk, 30c. per 100 lb.; hydrated lime, 40c. per 100 lb., gross weight; limestone, broken or crushed in bulk, 15c. per 100 lb.; ground limestone in bags, 7½c. per 100 lb., and ground limestone in bulk, 5c. per 100 lb.

Boron Deposits Should Be Under Leasing Act, It Is Thought

Proposed Also To Include Gilsonite in Bill Introduced by Representative Mays, of Utah

Bills intended to bring deposits of boron minerals under the terms of the general Mineral Land Leasing Act have been reported favorably to the Senate and to the House by their respective committees on Public Lands. The Secretary of the Interior recommends this legislation, as colemanite and priceite do not come under the provisions of the leasing act. The borates of potassium and sodium come under the act, but the minerals from which borax is derived are the borates of calcium. The secretary calls attention to the fact that the boron deposits are so closely allied with the sodium minerals that are covered by the leasing act that it is highly desirable to include boron deposits under that law.

Representative Mays, of Utah, has introduced a bill providing for the placing of gilsonite deposits under the general Mineral Land Leasing Act, Uintahite, or gilsonite, is a type of asphalt which occurs in Utah.

After extended debate the Senate on Jan. 14 passed the bill providing for the incorporation of the United States Fixed Nitrogen Corporation.

NEWS BY MINING DISTRICTS

Special London Letter

Metal Market Conditions Worrying Companies — Many Unable to Finance Carrying Unsold Metal

BY W. A. DOMAN

London, Jan. 18—The decline in the price of metals has greatly upset the mining world on this side. Programs of working and extensions were drawn up at a much higher level, so that the slump, accompanied by a lessening of demand, is creating considerable anxiety. Though the majority of the producing companies are ably managed, the position is such that many of them lack the financial resources to carry current production and hold stocks until such time as consumption increases. These observations are applicable to mining undertakings of almost every class. In copper there is the Arizona Copper Co. as well as some of the Australian mines. Many gold-mining companies in South and West Africa and elsewhere would be only too pleased if they could issue new shares or even debentures for working capital purposes. The decline in the dollar exchange this week administered a reminder to holders of Kaffirs that the gold premium is an unstable thing, and many of the mines have once again been brought to the point where revenue is only the merest shade above working expenditure. It is partly for this reason that the share market remains in such a dull condition; though it must not be overlooked that the "enemy" shares in the hands of the Home and Union Government are still unsold. The Transvaal gold output for December was very disappointing, being only 632,215 oz. For the last year the total was 8,153,625 oz., as compared with 8,330,091 oz. in 1919. The companies seem to have estimated that they will receive about £5 15s. per fine oz. for their gold of last month, though in addition they expect 4s. per oz. profit on exchange. This is exceptionally good if it be true.

At Broken Hill the position has become serious. It is reported that in consequence of the low prices of metals operations cannot be conducted at a profit. As great hardship would be caused by a total cessation, the larger companies have agreed to work on a reduced scale. The story is just the same where tin is concerned, if it is not even worse. Take the home industry first. Dolcoath shares are valued at something like 9d. each, and there is talk of reconstruction with a liability of 10s. a share. The directors want at least £120,000, and it is quite on the cards that they will ask shareholders to put up £150,000 or £160,000. Rather than be thrown out of work men at other Cornish properties are offering to assist the finances by contributing from their earnings.

Very few Nigerian companies are producing at a profit. The Northern Nigeria (Bauchi) reconstruction scheme has not yet been brought forward, because some large shareholders are suggesting that if the hydraulic scheme is postponed the company could get along without additional funds. The Jantar is asking its shareholders to subscribe £25,000 in five-year 10 per cent debentures, repayable at a premium of 20 per cent.

In normal times there would be a fair amount of excitement in anticipation of the striking of the reef in the Brakpan new area on the Far East Rand; today the market is quite apathetic. Results are looked for any day now, and if satisfactory will supply a much-needed fillip to Brakpan shares.

Erratic movements have taken place in Esperanzas again. A recent development cablegram showed values on the Descubridora vein on the 5th level to be over £50 to the ton. As a result the price advanced sharply, but speculators have since taken their profits.

In the matter of copper the Rio Tinto is again at work, though the principal output of this extensive property is pyrites. Perhaps the principal individual producer of the metal outside the American continent is the Union Minière du Haut Katanga, in which the Tanganyika Concessions is so largely interested. The report of the latter covering the eighteen months to June 30 last is issued today. It shows that in 1919 the total output was 23,004 tons of the metal, and last year about 19,000 tons, two labor strikes in the country having caused a cessation of operations in the latter period. The full capacity of the Union Minière plant is 40,000 tons annually. Hitherto only the high-grade ore has been treated. A concentrator for the treatment of the low-grade ore on a large scale—4,000 tons of ore a day—is now approaching completion and is expected to start work in the early part of this year. The company, it will be seen, is a formidable competitor to other copper-mining companies.

CANADA

Ontario

Goldfields, Ltd., Shareholders Approve Sale Conditionally—Rex Mill Started

Larder Lake—A meeting of the shareholders of Goldfields, Ltd., on Jan. 22 approved of the proposed sale of the assets to the Canadian Associated Goldfields, Ltd., on condition that the Associated Goldfields Mining Co. turns over its assets to the Canadian Associated Goldfields, and that J. Y. Murdoch, acting on behalf of some shareholders, is allowed full access to the books, reports and records of the companies to determine whether the proposed basis of the sale is a fair one.

Herb Lake—At the Rex mine the shaft is down 220 ft. and the mill was started Jan. 17. There are 20,000 tons of milling ore on the dump. The property has been electrically lighted.

British Columbia

Ainsworth—After negotiations extending over a period of several weeks, E. J. Edwards and associates, of Spokane, have secured a lease and bond on the Lakeshore group of claims from D. F. Strobeck.

Stewart—Two 5-ton Holt tractors have been delivered to the Premier company for use between the wharf and Nine-mile. Two large trailers have been ordered.

Trail—Ore shipments received at the Consolidated smelter during the week ended Jan. 21 totaled 6,621 tons. Shippers were as follows:

Mine	Location	Wet Tons
No. One Mine (Lease)	Ainsworth, ...	112
North Star,	Kimberley, ...	31
Paradise,	Lake Windermere,	32
Sutherland & Thompson	Beaverdell, ...	7
Company mines		6,439

AUSTRALIA

Mount Quamby Gold Strike Draws Attention — Cobalt Ore From Cloncurry Field Shipped to London

From Our Special Correspondent

Brisbane, Dec. 15—Much interest is being taken in the cobalt mine in the Cloncurry district. Over a dozen men are employed on the holding, and two shafts have been sunk, one to a depth of 90 ft. and the other down 120 ft., with a good lode all the way from the surface. In the shaft where most of the work is being done a level is being driven at a depth of 112 ft. An orebody has so far been developed 5 ft. in width, assaying approximately 4 to 5 per cent metallic cobalt. A 50-ton lot of ore is now being sent to London for treatment.

The gold discovery in the Cloncurry field is attracting much attention. The area called Mount Quamby has been visited by H. Phillips, a mining engineer on the staff of a Bendigo (Victorian) company. Mr. Phillips, whose company bought the mine from the original owners (Gulliver Brothers), has said that the show is one of the largest surface prospects in Australia. The orebody, he says, is 50 ft. wide on the surface. He added that the geological nature had not yet been definitely decided. Shares in the company paid up to 2s., it is reported, and have been already sold at 8s. The more cautious, however, want to know how the samples so far tested were taken. To afford this information the Mines Department has sent one of its most reliable geologists, L. C. Ball, to examine the field.

The Mount Cuthbert Co., operating in copper on the Cloncurry field, shows a loss of over £24,000 for the half-year ended Aug. 31 last. This is the company the manager of which stated the company could produce copper at a cost of £61 per ton, and while it was at work the market price ranged more than £20 above that figure. In fairness, however, it should be explained that the company operated during the term under exceptional handicaps, including a shortage of skilled miners, a seamen's strike, and a difficulty in obtaining explosives. During the half-year the smelter ran only 99½ days, producing 1,116 tons of blister copper from 17,912 tons of ore treated, of which practically a half came from the Kalkodoon mine. The general manager estimates the ore reserves at 193,500 tons, containing 13,185 tons of copper.

MEXICO

Sinaloa

Chichi Vanadium-Silver Mine Being Examined — Guadalupe de los Reyes Suspends; Also Copala Company

Mocorito—The Palmarito Leasing Co., in the Mocorito district, has started extensive development. Its purpose is to sink vertical shafts to get under the main orebodies. The vein is 90 ft. wide in places, and all work to date has been open cut. Eventually the 80-ton mill will be replaced with one of at least 500 tons' capacity. There will be a new power unit with wood for fuel. This is an enormous silver deposit carrying about 12 oz. per ton, and the ore is suitable for cyaniding.

Culiacan—The Chichi mine is being examined by Stanley A. Spellmeyer, for R. H. Townsend and associates, of New York. This is an old silver producer of fifty years ago out of which a large quantity of silver-lead ore was taken and treated by pan amalgamation. The property was abandoned about thirty years ago, on account of depth and consequent high mining costs. It was acquired again through denouncement by ex-governor Ramon F. Iturbe, in 1916. Since then ore has been found to contain considerable vanadium in the form of vanadate of lead. There is a twenty-ton concentrator on the property capable of making concentrates carrying about 11 per cent V_2O_5.

The Realito mine is a gold property in the Culiacan district, and is under option for purchase by Dr. P. B. Brooks and associates. This property has produced free-milling gold ore of a $12 grade for a number of years, and is said to have large ore reserves of the same grade. This is a cyaniding ore and is now being put in condition to work on a large scale. This property was abandoned during the revolution, and has not been worked for eight years.

Cosala—The Prieta mine is being worked by E. A. Montgomery and associates, from Los Angeles. This mine is said to have extensive ore reserves of a silver-lead ore carrying about 30 oz. silver. A thirty-ton flotation mill was installed last year but proved inadequate, and a new mill is now being installed with larger capacity and it is predicted that big silver returns will be shown on the resumption of operations with the new mill. J. C. Bone is in charge of operations at the mine.

The famous Guadalupe de Los Reyes mine, also in the Cosala district, has been obliged to suspend on account of

the low silver market. This is one of the most famous of the old Spanish mines, and has a history dating back about 300 years. This property belongs to the Spanish house of Francisco Echeguren, with offices in Mazatlan and San Francisco, Cal. It has been worked in recent years by the cyanide and flotation processes, but the combination of deep mining and low silver market has made it necessary to suspend temporarily.

The Copala company, belonging to Charles Butters and associates, has also been compelled to suspend on account of the value of foreign silver. This is supposed to be one of the big silver deposits of Mexico, and is said to have a 500-ton mill which was without equal in completeness at the time it was built about twelve years ago.

The Nuestra Señora mine, in Cosala, is operating at full capacity. This is a large silver-lead property belonging to San Francisco capitalists. E. H. Hoag is manager. The company is operating a 100-ton flotation mill.

Hidalgo

Commission Cause of Dam Failure at Pachuca

Pachuca—Since the breaking of the Xotol dam, inundating several of the contiguous mines and flooding the country around, causing the death of over one hundred persons, numerous letters and petitions have been forwarded to Mexico City accusing the Maravillas Mining Co. as responsible for the catastrophe. President Obregon has named a commission of engineers to study the accident to determine the cause.

VENEZUELA

Outlook Poor for Gold Mining in Venezuelan Guiana

There was no progress of importance in gold mining in Venezuelan Guiana during the last year. The Callao Co. started crushing after being stopped since 1914, but again stopped owing to want of development. The Goldfields of Venezuela continued to produce on a small scale, most of their attention being centered on development. The Bottanamo mine is reported to have been sold to an American syndicate.

A new mine code was again passed by Congress, but the only alterations were in connection with petroleum, a great many concessions for which were taken up by different oil interests. All these concessions are situated north of the River Orinoco, the best known being in the Maracaibo district in the northwestern part of Venezuela.

The output of alluvial gold fell off to a few hundred ounces per month, work on the Alto Cuyuni River being more or less at a standstill, as the owners of concessions are unable to make them pay and have not the capital to put them on a modern basis.

A new find is of some interest locally (situated about fifty miles south of El Callao), where owing to scarcity of water no washing can be done at present. However, over 400 oz. of coarse gold, including many nuggets, were recovered last month, working with pick and shovel only, the dirt being stored until there is rain.

Speaking generally, the outlook is not bright as regards gold mining. No new capital has been put in apart from the Callao Co., despite there being several new prospects of considerable promise. The chief obstacles to development of the district have always been the want of good transport facilities; namely, roads and the high cost of the inefficient labor. Freight to the mines costs at present $80 per short ton. The high cost of power may also be included. Corporations with capital sufficient to overcome these difficulties are required.

GUIANA

About 30,000 Tons of Bauxite Shipped From Demerara to U. S. Last Year

In British Guiana the bauxite crushing and drying plant of the Demerara Bauxite Co., Ltd., was completed and put into operation last fall and a small tonnage of bauxite was shipped to the United States. During the summer shipments of undried ore were made, but in the late fall several cargoes of dried ore were shipped. The company's plant is situated at Mackenzie, about fifty miles inland from Georgetown, and mines are being operated near that place. A total of about 30,000 tons of bauxite was shipped from British Guiana to the United States during 1920.

Construction work was continued during the year on the crushing and drying plant of the Surinaamsche Bauxite Maatschappij at Moenge, Dutch Guiana, about 100 miles inland from Paramaribo. Bauxite deposits near this place are being opened up, but no ore has been shipped from them up to the present.

ARIZONA

Copper Queen's Southwest Shaft Completed to Surface

Bisbee—Pumping equipment has been installed on the 1,800 level of the Calumet & Cochise shaft of the Copper Queen. The installation consists of two electrically driven 500-gal. pumps. The power is obtained from the company's new power line from Douglas.

The new Southwest shaft has been completed from the Queen Tunnel level to the surface. The shaft was raised from five different levels and has a total length of nearly 800 ft. A hoist will be installed on the surface.

The Junction shaft of the Calumet & Arizona Mining Co. has resumed operation after a five-day shutdown, during which time a new air line has been installed.

The Irish Mag Leasing Co. has struck ore in a raise from the 10th level.

The Boras Leasing Co. has paid its eighth monthly dividend of 10c. per share.

Oatman—The Snowball Miners' Union of this camp and the only one active in Arizona has refused to accept a cut of wages to $5.50 a day for shaft men, $5 for miners and $4.50 for muckers, this being a drop of $1 a day, which also applies to mill hands and other employees. A notice of this reduction, effective Feb. 15, was recently posted by the Oatman Mine Operators' Association. Oatman is exclusively a gold-producing camp through two mines, the Tom Reed and United Eastern. The camp is suffering from an epidemic of smallpox, and the union has warned against the coming of more workmen.

Silverbell—El Tiro has cut commercial ore on the 300 level. At present it averages about 5 per cent copper and is easy to mine.

Humboldt—Robert McMurchie, attorney for G. M. Colvocoresses, receiver for the Consolidated Arizona Smelting Co., states: "We are working toward a reorganization of the company to protect the creditors and to prevent the mining property, mill and smelter from being junked in the bankruptcy court."

Duncan—Excavation is about completed for the new 100-ton mill at the Ash Peak mine. One car of machinery has arrived.

COLORADO

Old Wanakah, at Ouray, To Be Reopened—National To Dredge in McNulty Gulch

Leadville—Though the National Mining & Development Co.'s holdings in Lake County are idle, the properties controlled in and near Kokomo are active, and the company is planning much work in that territory. A compressor, hoist, motor, and other equipment have been shipped into Kokomo from Leadville, and will be installed immediately on the Golden Queen property, which adjoins the Queen of the West claim. Arrangements have also been made to secure power. In McNulty Gulch, churn drilling of a large piece of the company's ground has shown the installation of a dredge there to be practicable. The ground is said to run from $1.05 to $4.10 per cu.yd. The dredge has been purchased.

The company recently bought the Hercules placer, on which the townsite of Kokomo is situated, and the manager, Paul Maurer, intends to sink on this property.

Ouray—The old Wanakah, formerly known as the Bright Diamond and Ironclad, is to be reopened by the Union Mining & Milling Co., under R. E. Myers, of Ouray. Mr. Myers announces that he has bought a Ruth flotation machine, besides other equipment. The company intends to remodel the Wanakah mill, flotation never having been practiced there formerly.

The mine is in good condition to resume work, being a large nearly flat or "contact" orebody, with little caving ground. The property is well equipped. The last operations, which included rather extensive pyritic smelting at the Ouray smelting plant, were down to heavy pyrite carrying low values in gold and copper.

UTAH

Ontario at Park City Increases Pumping Capacity

Park City—Shipments of crude ore and concentrates for the week ended Jan. 22 amounted to 1,930 tons, as compared with 1,911 tons the week before. Shippers were: Judge companies, including Judge, Daly West, Daly and Park-Utah, 899 tons; Ontario, 499, and Silver King Coalition, 541. At the Ontario the work of installing the electric pump on the 1,700 level is completed, and the total pumping capacity brought to 2,500 gal. per min., sufficient for all possible needs. Increased development on the 2,000 level will now be undertaken and shipments increased.

The Silver King Cons. is driving a three-compartment raise from its Thaynes Canyon tunnel to follow a group of fissures in the quartzite to the contact with the overlying limestone. The raise is up 130 ft. and the distance to the contact is estimated to be 200 ft. The tunnel when completed will extend under the California-Comstock workings acquired some time ago and eventually make available low-grade ore here accumulated and partly developed.

Eureka—Shipments from the Tintic district for the week ended Jan. 22 were 177 cars, as compared with 184 the week before.

At the Tintic Drain Tunnel work is being done on a raise, which will connect the tunnel with the surface 600 ft. above. Lessees are shipping from the Iron Blossom. The company is doing development work on the 2,200 level.

At the Dragon Consolidated iron ore for fluxing is being taken on by one of the Valley smelting companies.

IDAHO

Over 3,000 Employed in Cœur d'Alene District

Wallace—All mines in the Cœur d'Alene district except two are working with almost normal forces. The two idle are the Callahan and the Gold Hunter, the former employing 350 men and the latter 175. According to careful estimate the companies now in operation employ the following number of men: Bunker Hill & Sullivan, including smelter, 1,200; Morning, 500; Hecla, 400; Hercules, 500; Tamarack, 200; small mines, leases and development companies, 500; total, 3,400. The standard wages is $4.50 and $4.75 per day for muckers and miners respectively. Some of the smaller companies and lessees pay higher in order to secure good all-round men. There are plenty of men for the jobs, a situation that has resulted in a notable increase in efficiency.

Burke—Marsh Mines has two shifts working in the Russell tunnel, the purpose being to extend it to the east end line and there raise on the vein to surface to secure physical proof that the apex of the vein crosses the end line.

MONTANA

Anaconda Suspends All Zinc Operations Owing to Large Stocks

Butte—The payroll of the Anaconda Copper Mining Co. has 4,500 names on it approximately, according to an official of the corporation. In the decision of the U. S. Supreme Court setting aside the sale of the Alice Gold & Silver company to Anaconda, as told in the issue of Jan. 29, the Anaconda was held to be a combination not in restraint of trade. It is said that the company may purchase the Alice minority interest.

On Feb. 1 Anaconda announced the suspension of all zinc operations, owing to large stocks of the metal. Seven hundred men were affected.

High-grade silver ore has been opened in a raise on the 600-ft. level of the Hibernia mine, of the Davis-Daly company, and the grade of shipments for January, in addition to showing a larger tonnage, it is expected, will record a higher silver content. Shipments for the last month aggregated 103 carloads, with the average silver assay 18 oz., as compared with the returns now of about 36, which it is expected will bring the average for the month around 25 oz. The airshaft being raised from the 1,700-ft. level of the Colorado to the surface has been completed.

Station cutting is under way at the 2,500-ft. level of Butte & Superior's Black Rock mine, the No. 3 shaft now being more than 50 ft. below this level. The shaft is now in the Rainbow vein, and is showing a good tonnage of zinc ore, ranging from 10 to 40 per cent of the metal.

At the Butte Western Silver mine, sinking from the 200-ft. level is under way. At a depth of another 100 ft. ore shoots in evidence on the 200 level will be crosscut.

Champion District—The larger part of the development work in the Champion mine of the Butte Jardine has been suspended, and efforts are being devoted to getting the 150-ton mill under way as early as possible. Within forty to sixty days it is expected to be possible to start operations. Sufficient tonnage for three years is reported.

OREGON

War Eagle Starts Quicksilver Furnace —Bartons Win Chrome Suit

Gold Hill—In spite of the low price now ruling for quicksilver, the War Eagle Mining Co., in the Gold Hill district, has started its new Scott furnace, recently completed. This mine was first open and operated in 1916, and the present equipment and development work to date represents an outlay of over $50,000. The total output of the mine to date with two 12-pipe mercury furnaces is 42,375 pounds or 565 flasks.

Grants Pass—A decree in the Circuit Court of this county in the suit of Rowan vs. Barton et al., over a Government war contract for the delivery of chrome, has been decided in favor of the defendants.

CALIFORNIA

Uankee Hill Gold Dredging Co. Suspends Operations

Oakdale—Work started a few weeks ago has been suspended by the Uankee Hill Gold Dredging Co. as a result of a fight over control. E. R. Healy owns 51 per cent of the company's stock.

Placerville—The financing of the Duncan-Adams property by employees of the Western Pacific is about completed. The property consists of 740 acres, known as the Duncan Ranch, situated on the Mother Lode in El Dorado County.

Grass Valley—On Jan. 21 a strike was made on the 600 level of the Allison Ranch mine, where persistent search for new orebodies has been under way for many months. Approximately $800,000 has been spent by the Grass Valley Consolidated Mines Co. in reopening the Allison Ranch.

The Alcalde mine, in the Rough and Ready district, has been closed temporarily pending a readjustment of the affairs of the company.

NEVADA

Consolidated Mayflower Resampled—Con. Virginia's Capitalization Increased

Tonopah—The latest reported bullion shipments from the mills of this district, representing the clean-up for the first half of January, indicate a gross production for January of about $600,000 in gold and silver. The Tonopah Belmont shipped $91,300, West End, $53,460, Tonopah Extension, $56,000, in bullion, with the Tonopah Mining Co. and MacNamara shipments not yet announced.

Divide—In the Tonopah Divide mine drifting and crosscutting of the vein on the 800 and 1,000 levels have disclosed no changes.

Pioneer—The mine of the Consolidated Mayflower has been resampled, and the management announces that there is considerable ore of milling grade in sight. Development during the last year has been satisfactory, and under improved operating conditions the mill is to resume in March.

Virginia City—The capitalization of the Consolidated Virginia has been increased from 216,000 shares to 2,160,000 shares, exchange basis for stock to be ten new shares for one old.

Eureka—Ore shipments to Utah smelters from this district during the last week were as follows: Eureka Holly, 4 cars; Eureka-Croesus, 2 cars; and Richmond Eureka, 24 cars of speiss. The Logan shaft of the Ruby Hills Development Co. is being unwatered, and progress is satisfactory.

Kimberley—The Consolidated Coppermines, which closed down recently to a caretaking basis, is selling its commissary supplies at reduced prices.

Nevada Consolidated is operating at reduced capacity, and has accomplished reduction of wages without difficulty.

Arrowhead—The Arrowhead district

is not booming, but considerable mining is being done, with prospects of future activity. Other camps that do their business through Ely are quiet. Ward is closed down. A rich strike was recently made at the Silverton mine, near Ely. Assays gave 247 oz. of silver to the ton. Little work has been done, but the find created much interest.

Pioche — Ore shipments from the Pioche district for the week ended Jan. 20 were below normal, on account of severe weather, totaling 2,750 tons. Shippers were: Prince Con., 1,550 tons; Virginia-Louise, 750; Bristol Silver, 255; Black Metals, 145; and Lee-Mathews Lease, 50.

Battle Mountain—The Copper Canyon Co. has reduced miners' wages $1 per day, at the same time reducing board 25c. The Betty O'Neal reduced wages 75c. and board 25c. per day. The Nicklas Mining Co. will cut wages 50c.

SOUTH DAKOTA

Anchor Mountain Resumes—American Minerals Installing Mica Stamping Equipment

Galena—The Anchor Mountain Mining Co. has resumed work on its property and the plant is being put in readiness. The company hopes to have the mill in use early in the summer. It plans to enlarge the mill.

Keystone — The American Minerals Co. is installing machinery for stamping mica. It is proposed to cut considerable of the material at the plant and the company will also later install a mica grinding mill. The concern is a new incorporation and has already started work at its property. It owns considerable mica ground near Keystone and has also taken options on additional claims.

WISCONSIN

Zinc-Lead District

Wisconsin Zinc Co. Again Closes Mines —Nightingale Shaft Completed

Benton—The Nightingale company, which is developing the Pedelty, Sherry and Buxton lands at Leadmine, has completed a new shaft and mill immediately east of the old Drum property. Joseph Piquett, of Platteville, is general manager.

Cuba City—The Connecting Link has struck a rich vein of blende on the Coulthard lease where it is operating mill No. 1, recently completed. Shaft and mill No. 2 have just been closed due to low market. C. M. Treat, of Cuba City, is general manager.

Livingston—Levi Pollard and others are sinking a new shaft on the Ross land two miles west of the Yewdall; the property was proved by drilling.

Platteville—The Wisconsin Zinc Co. has again closed its mines but has resumed operations at its roasting plant, where it has accumulated 4,500 tons of green blende during two months' shutdown.

C. O. Anderson, assistant metallurgist for the U. S. Bureau of Mines, has arrived in Platteville and will be followed soon by Will H. Goghill, metallurgist. Their laboratory apparatus and machinery is now being installed in the ore-dressing laboratory of the Wisconsin Mining School and full preparations are being made to make the preliminary tests on the ores of the Wisconsin zinc district. The first tests will be flotation tests on sludge from the various mills.

Missouri-Kansas-Oklahoma

Vinegar Hill Company Takes Up Option on Texas Lease, After Drilling

Picher — The Vinegar Hill Zinc Co. has closed its option on the lease and mill of the Texas Mining Co., east of Picher, after careful prospect drilling, and is beginning to sink a shaft and will drive a prospect drift immediately.

The Vinegar Hill Co. had a successful year at its Barr mine, north of Picher, in Kansas. With only one mill at this property it produced 10,080 tons of zinc concentrates and 4,709 tons of lead concentrate.

NEW YORK

Chateaugay Iron Mines Shut Down

Owing to depression in the steel market the Chateaugay Ore & Iron Co. has closed its big iron mines at Lyon Mountain, in the Adirondacks, for an indefinite period. During the shutdown a new shaft is to be sunk which will give employment to a small number of the miners at reduced wages.

MINNESOTA

Mesabi Range

St. Paul Mine May Be Reopened—Oliver Starts New Trestle

Hibbing—It is rumored but cannot be definitely ascertained that the St. Paul mine of the McKinney Steel Co., which has been idle for several years, will be reopened this spring.

The first 600-ft. section of a new trestle which will ultimately be about two miles long is being built by the Oliver Iron Mining Co. to afford new dump grounds for stripping from the Hull-Rust pit.

Duluth—Total shipments of iron ore to the Minnesota Steel Co. and the Zenith Furnace Co. at Duluth were 757,425 tons. The ore was shipped from five of the iron ranges, with the greatest amount from the Mesabi.

MICHIGAN

Efficiency of Labor Much Improved in Michigan Copper Country

Houghton—J. Parke Channing, president of the Seneca Mining Co., recently visited the property, and was highly pleased with recent developments, especially the block of ground being developed by the two raises at the south end of the 13th level of the Gratiot shaft. Sinking in this shaft will start at once and continue until the 33d level is reached.

The present surface equipment at the Seneca shaft is large enough to continue sinking to the 10th level, which will be done. The Gratiot and Seneca shafts will then be connected with a drift at what is the 33d level of the Gratiot.

The three mines of the Copper Range Cons. Mining Co. have been much undermanned for some time, due to the labor shortage. Although the management has not practiced voluntary curtailment of production, the effect on the metal market has amounted to much the same thing.

Labor in general throughout the Copper Country has shown a marked increase in efficiency during the last few months, amounting in some cases to fully 80 per cent. This, together with the increasing use of mechanical equipment, such as power shovels at the Copper Range and stope scrapers in the mines with flat veins, are all tending to reduce mining costs.

Gogebic Range

Wages Cut by All Operators Except Steel Corporation—Anvil Shaft Down

Ironwood—The Steel & Tube Co. has shut down the Anvil shaft of the Anvil-Palms-Keweenaw mine until business conditions improve. The Palms will probably continue on a reduced scale.

Ogleby-Norton, McKinney Steel, Pickands-Mather, and Republic Iron & Steel have all announced cuts in wages amounting in most cases to 15 per cent, effective immediately or on Feb. 1. Aside from the Steel Corporation the other range operators have reduced wages.

Menominee Range

Dunn and Tobin Mines Down—Pioneer Furnace at Gladstone Blown Out

Crystal Falls—The Dunn and Tobin mines have been closed for the winter, and the Odgers has reduced its working force owing to market conditions. These companies have little ore in stock.

Gladstone — The Pioneer furnace of the Cleveland-Cliffs company has been blown out and 275 men are out of jobs as a result. There are big stocks of charcoal pig in the furnace yards that cannot be disposed of, the market being demoralized. An operation providing hardwood for charcoal purposes has also been stopped, releasing 175 men.

Marquette Range

Surplus of Labor in All Mining Camps

Ishpeming—A shortage of water at the hydro-electric plants of the Cleveland-Cliffs company has forced the use of coal for operating the mines in the Ishpeming, Negaunee, Gwinn, and Princeton fields. An unusually dry fall and winter is the cause. More storage capacity is being planned that will obviate this trouble.

All iron-mining organizations in the Lake Superior region, except those of the Oliver company, have reduced wages 15 per cent. There is a surplus of labor in all mining towns.

The M. A. Hanna company is removing buildings from the American mine location to Wakefield, on the Gogebic Range.

THE MARKET REPORT

Daily Prices of Metals

Jan.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
27	12.50	31.00	34.75@35.00	4.75@4.85	4.70@4.75	5.20@5.25
28	12.50	29.50	33.50@33.75	4.75	4.65@4.70	5.10@5.20
29	12.50	29.50	34.00@34.25	4.75	4.60@4.70	5.10@5.20
31	12.50	30.00	33.50@34.00	4.70	4.60	5.05@5.15
Feb. 1	12.50	29.50	32.75@33.00	4.65@4.70	4.60	5.00
2	12.50	28.75	32.00@32.25	4.60	4.50	5.00

*These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
27	69½	70⅛	77	174½	180½	23¼	23¾	24	25
28	67¾	68¼	76	167½	173	23¼	23⅝	24	25
29									
31	67¾	68½	75½	168½	174½	23¼	23¾	24¾	25¾
Feb. 1	69½	70	76	168¼	173¾	23½	23½	24½	25½
2	69¼	69¾	76	162½	168¾	22¾	23¼	24	25

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Jan.	Sterling Exchange	Silver			Jan.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
27	386	99½	66⅜	39⅝	31	385	99½	59⅞	35⅛
28	386¼	99½	64½	37¾	Feb. 1	378½	99½	57¾	34½
29	385¾	99½	62¾	36¾	2	382¾	99½	61½	36¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Monthly Average Prices for January:

Copper:	
New York Electrolytic	12.597
London Standard	70.964
London Electrolytic	79.119
Lead:	
New York	4.821
St. Louis	4.747
London	23.387
Silver:	
New York, foreign	65.950
New York, domestic	99.500
London	39.985
Sterling Exchange	372.650
Zinc:	
St. Louis	5.413
London	25.262
Tin:	
99 per cent	31.470
Straits	36.000
London	190.464
Antimony	5.258
Quicksilver	48.440

Metal Markets

New York, Feb. 2, 1921

No improvement in the domestic demand for any of the metals has taken place during the last week. The prices of lead and zinc have continued to sag, but copper has remained stationary and seems to be scraping bottom.

Copper

Demand for prompt metal is almost non-existent, and our prices, therefore, represent offerings rather than sales. Orders for delivery as late as April have been accepted on a 12.75c. delivered basis, but 13@13.25c. is the usual figure for forward delivery.

The most interesting feature of the copper market in the last week was the plan announced in today's morning papers for financing foreign sales. This news leaked out prematurely, and the scheme has so far only been proposed. Definite action may be taken at a meeting to be held on Friday. The plan essentially is as follows: Four hundred million pounds of copper now in stock in the hands of those who enter into the agreement is to be set aside for export. Debentures will be issued against this metal, guaranteed by the large producing companies and by banks, which will pay 8 per cent, and will be sold to the public. As the metal is sold these debentures will be retired. It is also rumored that a curtailment of production will be guaranteed until the stocks are marketed, though whether this means that present curtailments will be continued or that production will be further decreased, we do not know. The plan is merely a method whereby present stocks can be carried by offering an attractive investment to the American public, and apparently will in no way aid European buying. It will, however, relieve the producers of the onus of carrying their large stocks, and will tend to avoid forced sales and cut-throat competition.

Lead

Lead is weaker again, owing to a pronounced drying up of demand. The only sale of any magnitude of which we heard was one of 500 tons to one of the electrical companies, which aroused considerable competition. There is some inquiry for forward delivery, but most producers feel that the price is likely to go up again in two or three months, and are not willing to quote beyond March. In fact, some interests are not anxious to sell even current production at present prices.

Zinc

The continued price recessions are resulting in further reductions in production. Anaconda shut down its electrolytic zinc plant yesterday, and several other plants will run only a few days longer, or until present ore stocks are exhausted. The galvanizing business is reported improving somewhat, but demand for zinc is still weak and confined generally to single cars or fifty-ton lots. Zinc for forward delivery commands a slight premium, but sellers are not interested in futures, as sales now made are the result of a need for ready money.

Tin

Tin has fluctuated with London and sterling exchange, rather than with local demand, as usual. Business is fair for small lots. Reports of large stocks in this country are almost certainly erroneous, and no considerable quantities of any grade of tin seem to be immediately available.

Straits tin for future delivery: Jan. 27th, 35.50@36c.; 28th, 34.50@34.75c.; 29th, 34.50@34.75c.; 31st, 34.25@35c.; Feb. 1st, 34@34.25c.; 2d, 33@33.25c.

Arrivals of tin, in long tons: Jan. 27th, London, 25; 28th, London, 275. Total for January, 1,245.

Gold

Gold in London: Jan. 27th, 106s. 3d.; 28th, 105s. 7d.; 31st, 106s. 1d.; Feb. 1st, 107s. 2d.; 2d, 107s.

Foreign Exchange

The recent strength of sterling is well maintained, but the general opinion seems to be that even if $4 is reached that will be a hard point to pass. Other foreign money is, in general, slightly stronger than a week ago. On Tuesday, Feb. 1st, francs were 7.04c.; lire, 3.64c.; and marks, 1.58c. New York funds in Montreal, 12⅝ per cent premium.

Silver

Since our last report there has been a steady decline in the London price from 40d. on Jan. 26 to 34½d. on Feb. 1. Selling by China and the Continent has been responsible for the weakness. During the same period the New York market dropped from 66⅝c. to 57⅞c., moderate business only being done. Today London advanced sharply to 36¼d. on the strength of Indian bazaar and China buying, New York also advancing to 61½c. Buying inquiry for China account also developed in the local market on the advance.

Mexican Dollars—Jan. 27th, 50¾; 28th, 49¼; 29th, 48; 31st, 45½; Feb. 1st, 44⅛; 2d, 46⅝.

Other Metals

Aluminum—List prices of 28.3@28.5c. are nominal. Outside market 24@25c.

Antimony — Chinese and Japanese brands, 5⅛@5⅝c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9⅜c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

Bismuth—$2.30@$2.40 per lb., 500-lb. lots, and $2.42 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

Magnesium — Crude, 99 per cent, $1.25@$1.35 per lb., f.o.b. Philadelphia.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J. Virgin metal in open market 38@40c.; remelted, 35@37c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—Firm at $70@$75 per oz.

Quicksilver—Nominally $50 per 75-lb. flask. San Francisco wires $49. Quiet.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

[1]**Manganese Ore**—38@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit ow WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 29—Zinc blende, per ton, high, $30.55; basis 60 per cent zinc, premium, $25; Prime Western, $25@$22.50; fines and slimes, $22.50@$17.50; average settling price, all zinc ores, $28.63 per ton.

Lead, high, $53.30; basis 80 per cent lead, $50@$51; average settling price, all lead ores, $51.39 per ton.

Shipments for the week: Blende, 5,173; lead, 1,403 tons. Value all ores the week, $220,210. Shipments for January: Blende, 25,293; lead, 3,581 tons. Value, all ores the month, $977,370.

The larger tonnage of the week was purchased on $25 basis. Thursday the market was very weak, but recovered Friday after about 600 tons was sold on $22.50 basis, sellers declining to sell more on that basis. Limited purchases on $25 basis were again made on Friday, but as only one buyer was offering over $22.50, sales were only 4,550 tons at noon today.

Platteville, Wis., Jan. 29—No base price for zinc or lead ores. Shipments for the week: Zinc ore, 301; lead ore, 30 tons. Shipments for the year: Zinc ore, 1,199; lead ore, 390 tons. Shipped during the week to separating plants, 502 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,500; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20; No. 4, $2@$3; No. 3, $3.25@$3.50; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; ground, $60@$150 per ton (depending upon quantity); all f.o.b. New York. Ground mica in Philadelphia, $150 per ton.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18; all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $40@$50; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $110, f.o.b. seaboard bases; resale, $100; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $45, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $55@$60; 50 per cent, $78@$80; 75 per cent, $140@$145.

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $5.75@$6.75 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $80 per net ton, shipping point; arches, keys, wedges, $85; splits, soaps, $100.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

Iron Trade Review

Pittsburgh, Feb. 1, 1921

A more hopeful sentiment pervades the iron and steel trade, particularly in the east, but no material increase in the volume of business can be traced, thus far at least, to the improvement. The independents had no back orders to fill at the beginning of the year, but the Steel Corporation had a large volume of specified business, and naturally the unfilled business is diminishing. The Carnegie Steel Co. still operates at about 96 per cent of capacity, and the National Tube Co. is running full, but the wire subsidiary, together with the subsidiaries at Chicago and Birmingham, is gradually tapering off in operations. The Steel Corporation's operations as a whole, however, are probably nearly if not quite 90 per cent.

Rumors of price cutting in most finished-steel products continue, but are not usually verified, and it is to be noted that if there was as much cutting two or three weeks ago as was then reported some of the market would probably have broken open by this time. On the whole, the market can be reported steady at the Industrial Board schedule.

An actual increase in demand is expected by April 1, though no one predicts even moderately full operation for the mills before next October.

Pig Iron—Foundry pig iron has been offered by furnaces at $30, Valley, or $1.50 under the previous quotation, without important tonnage being moved. Bessemer and basic remain at $32 and $30, Valley, with no inquiry.

Semi-finished Steel—Nominal asking prices remain at $45 for billets and $47 for sheet bars, with consumers showing absolutely no interest.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville — Furnace, $6.25@$7; foundry, $5@$5.50.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	.....	85.005	.....	337.466	.....
March	125.551	.....	74.194	.....	370.870	.....
April	119.779	.....	68.848	.....	392.438	.....
May	102.585	.....	60.010	.....	383.360	.....
June	90.957	.....	51.096	.....	393.663	.....
July	91.971	.....	53.736	.....	385.538	.....
August	96.168	.....	59.875	.....	360.404	.....
September	93.675	.....	59.476	.....	350.370	.....
October	83.480	.....	54.197	.....	346.460	.....
November	77.234	.....	50.952	.....	342.333	.....
December	64.774	.....	41.845	.....	348.101	.....
Year	100.900	.....	61.590	.....	364.840	.....

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	.....	120.188	.....	126.950	.....
March	18.331	.....	109.533	.....	118.348	.....
April	18.660	.....	103.025	.....	111.500	.....
May	18.484	.....	96.750	.....	109.200	.....
June	18.065	.....	87.864	.....	101.909	.....
July	18.576	.....	90.148	.....	106.455	.....
August	18.346	.....	93.935	.....	111.143	.....
September	18.144	.....	96.381	.....	111.905	.....
October	15.934	.....	93.327	.....	104.905	.....
November	14.257	.....	84.807	.....	94.614	.....
December	13.188	.....	75.702	.....	85.905	.....
Year	17.456	.....	97.480	.....	108.839	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4.747	47.095	23.387
February	8.814	.....	8.601	.....	50.256	.....
March	9.145	.....	8.894	.....	46.054	.....
April	8.902	.....	8.618	.....	39.225	.....
May	8.576	.....	8.352	.....	38.488	.....
June	8.323	.....	8.169	.....	34.330	.....
July	8.338	.....	8.283	.....	34.960	.....
August	8.687	.....	8.725	.....	36.304	.....
September	8.177	.....	8.160	.....	35.452	.....
October	7.070	.....	7.018	.....	35 238	.....
November	6.159	.....	6.127	.....	32.489	.....
December	4.727	.....	4.717	.....	24.089	.....
Year	7.957	.....	7.830	.....	37.832	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	.....	36.000	376.512	190.464
February	58.466	.....	59.932	.....	395.750	.....
March	61.037	.....	61.926	.....	369.489	.....
April	61.120	.....	62.115	.....	345.450	.....
May	53.230	.....	55.100	.....	294.813	.....
June	46.125	.....	48.327	.....	250.614	.....
July	45.798	.....	49.154	.....	261.886	.....
August	43.856	.....	47.620	.....	274.048	.....
September	41.940	.....	44.465	.....	270.120	.....
October	39.310	.....	40.555	.....	258.190	.....
November	35.667	.....	36.854	.....	241.080	.....
December	31.135	.....	34.058	.....	212.440	.....
Year	48 273	.....	49.101	.....	295.866	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262
February	8.708	.....	61.338	.....
March	8.531	.....	53.467	.....
April	8.184	.....	47.388	.....
May	7.588	.....	45.088	.....
June	7.465	.....	41.193	.....
July	7.720	.....	41.886	.....
August	7.835	.....	41.220	.....
September	7.661	.....	39.690	.....
October	7.150	.....	39.756	.....
November	6.247	.....	35.028	.....
December	5.824	.....	27.762	.....
Year	7.671	.....	44.372	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony and Quicksilver

	Antimony (a) New York		Quicksilver (b) New York	
	1920	1921	1920	1921
January	10.577	5.258	90.192	48.440
February	11.588	.....	84.432	.....
March	11.056	.....	92.611	.....
April	10.500	.....	102.192	.....
May	9.655	.....	89.560	.....
June	8.289	.....	90.154	.....
July	7.500	.....	90.333	.....
August	7.177	.....	83.806	.....
September	7.113	.....	75.000	.....
October	6.723	.....	67.200	.....
November	6.109	.....	58.417	.....
December	5.534	.....	49.577	.....
Year	8.485	.....	81.123	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	$40.47	33.96	$39.88	31.96	$39.86	33.88
February	42.95	.....	42.61	.....	43.40	.....
March	43.40	.....	42.90	.....	43.40	.....
April	43.72	.....	44.22	.....	43.90	.....
May	44.00	.....	44.88	.....	45.36	.....
June	44.89	.....	45.41	.....	46.40	.....
July	47.21	.....	47.42	.....	46.56	.....
August	48.90	.....	49.88	.....	49.35	.....
September	50.46	.....	50.46	.....	51.96	.....
October	49.21	.....	44.38	.....	48.58	.....
November	41.26	.....	39.20	.....	42.61	.....
December	36.96	.....	34.90	.....	37.73	.....
Year	44.45	.....	43.85	.....	44.93	.....

In dollars per long ton.

Monthly Crude Copper Production, 1920

	September(a)	October(a)	November	December
Alaska shipments	1,635,677	4,984,219	12,802,696	6,631,700
Arizona Copper	3,000,000	2,800,000	2,800,000	2,650,000
Calumet & Arizona	4,292,000	3,802,000	3,486,000	3,300,000
Con. Ariz. Smelting	950,000	865,000	750,000	476,000
Inspiration	6,500,000	7,000,000	5,350,000	5,000,000
Magma	663,219	750,814	671,752	600,000
Miami	4,549,140	4,582,293	4,505,232	4,373,123
New Cornelia	3,314,000	3,450,000	2,670,000	2,688,456
Old Dominion	1,957,000	2,912,000	2,563,000	2,655,000
Phelps Dodge	6,381,000	5,309,000	5,492,000	5,850,000
Shattuck Arizona	166,513	206,772	6,063	.....
Ray	4,502,000	3,990,800	3,975,000	2,975,000
United Verde	4,837,000	5,858,000	4,030,000	3,260 000
United Verde Extension	3,327,644	3,864,756	2,642,812	3,204,258
Calumet & Hecla	7,278,215	7,945,502	7,326,763	7,507,712
Other Lake Superior	6,000,000	6,000,000	6,000,000	6,000,000
Anaconda	11,100,000	11,000,000	11,100,000	10,500,000
East Butte	1,634,260	1,626,980	1,658,860	1,538,760
Nevada Cons	4,650,000	3,850,000	3,950,000	3,000,000
Chino	5,161,894	3,933,435	4,000,000	2,999,000
Utah Copper	8,420,000	8,000,000	9,120,000	7,500,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,600,000
Others, estimated	13,000,000	10,900,000	10,200,000	11,400,000
Total United States	104,919,262	105,231,571	106.700.178	95,709,009
Imports: Ore and concentrates, etc	10,132,777	9,626,502	7,143,610	6,331,559
Imports in blister, etc	20,428,866	24,559,763	31,148,088	34,619,919
Grand total	135,480,905	139.417.836	145,291,876	136,660,487
British Columbia:				
Granby Cons	2,239,174	2,293,500	2,465,585	2,665,018
Mexico				
Boleo	440,720	617,200	771,680	1,014,160
Cananea	3,500,000	3,500,000	3,500,000	3,700,000
Phelps Dodge Mexican properties	1,617,000	1,817,000	2,666,000	2,468,000
Other foreign:				
Cerro de Pasco	4,360,000	4,698,000	3,612,000	4,258,000
Chile	9,496,000	9,420,000	8,859,984	.....
Katanga	None	2,697,696	3,174,624	.....
Backus & Johnston	1,560,000	1,740,000	1,548,000	1,604,000

Comparative annual copper production follows:

	1918	1919	1920
January	165,431,568	135,733,511	121,903,744
February	160,011,364	111,649,512	117,450,000
March	185,525,168	102,040,460	120,309,316
April	163,207,096	98,808,998	116,078,871
May	181,070,350	92,652,975	114,964,207
June	166,723,599	95,856,570	116,107,856
July	159,329,031	100,369,247	109,729,510
August	165,550,799	107,994,040	116,460,654
September	157,992,487	108,703,075	(a) 104,919,262
October	168,638,775	115,143,143	(a) 105,231,571
November	159,217,588	117,289,735	106,700,178
December	161,801,916	102,997,633	95,709,009

(a) Revised

COMPANY REPORTS

Cape Copper Co., Ltd.

Copper; South Africa, India.

A report of the Cape Copper Co., Ltd., covering operations for the year ended April 30, 1920, in the Cape Colony, and to Aug. 31, 1920, in London and India, states that the revenue of the year has been derived chiefly from the small output of the incomplete plant at the Rakha Hills mines, in India, which was expected, according to the report, to be ready to produce the full output of 250 tons of copper per month before the end of 1920.

Mining operations in Cape Colony were suspended in May, 1919. Production for the three weeks prior to the suspension amounted to 520 tons of 16.2 per cent copper ore and 198 tons of 5.2 per cent ore from the Ookiep mine. The output of the Nababeep mine was 2,333 tons, assaying 4.7 per cent copper. Reserves at the mine are estimated to be 90,000 tons of 5 per cent ore and those at the Rakha Hills mines at 354,688 tons of 3.66 per cent ore. The accounts show a deficit of £163,627 18s. 10d. as follows:

PROFIT AND LOSS ACCOUNT

DEBITS

	£	s.	d.
Mining costs, viz.:			
Ookiep mine, including depreciation	14,264	9	4
Nababeep mine, including depreciation	6,589	2	5
Narrap mine, including depreciation	151	19	4
Relief of distress fund, Namaqualand	1,000	0	0
Rakha Hills mines	100,078	14	1
Trial mines and cost of inspections	406	15	5
Transport and shipping in the colony	9,489	5	8
	131,980	6	3
Management in London	6,502	18	4
Interest and discount	20,570	0	7
Miscellaneous expenses	9,232	5	5
Total	168,285	10	7

CREDITS

Copper ores and metal	3,127	12	4
Rent and stores	1,529	19	5
Balance carried down	163,627	18	10
Total	168,285	10	7

DEBITS

Balance brought down	163,627	18	10
Balance from profit and loss account 1918/19	51,501	0	7
Taxes outside the United Kingdom	514	12	7
Total	215,643	12	0

CREDITS

Transfer from income tax provision	25,972	12	11
Balance	189,670	19	1
Total	215,643	12	0

The company is capitalized at 400,000 ordinary shares of £2 each, of which 360,000 have been issued, and 75,000 6 per cent cumulative preferred shares of £2 each, of which 45,000 have been issued and fully paid. An issue of £120,000 of 8 per cent convertible debentures has been made.

Sulphide Corporation, Ltd.

Lead, Zinc; New South Wales

A report of the Sulphide Corporation, Ltd., for the year ended June 30, 1920, states that the net profit after payment of income taxes, London expenses, royalties, and other items amounted to £2,874 6s. 8d. Mining and milling operations at the Central Mine were suspended throughout the year because of labor troubles. At the Cockle Creek works, smelting and refining operations were continued on a restricted basis.

The acid and superphosphate plants worked intermittently throughout the year, the production being 13,222 tons and 17,398 tons respectively, compared with 15,524 tons and 25,448 tons in the previous year.

The Seaton Carew Zinc Distilling Works, in England, felt an ore shortage due to the difficulty of obtaining supplies from Australia. A total of 8,362 tons was treated, yielding 2,817 tons of zinc. The working account follows:

DEBITS

	£	s.	d.
Ore, concentrates and other products on hand in England and Australia, June 30, 1919	227,149	9	11
Central Mine			
Wages, maintenance, etc.	73,523	13	7
Cockle Creek			
Wages, purchased ores, fluxes, freight, maintenance, etc.	374,762	2	11
Central Zinc Works			
Wages, purchased ores, maintenance, etc.	151,687	5	6
Freight and charges on produce	2,411	8	7
Total	829,534	0	6
Balance, transferred to profit and loss account	32,394	12	0
	861,928	12	6

CREDITS

Sales of produce	810,023	18	9
Less in transit, June 30, 1919	57,326	11	3
	752,697	7	6
Products in transit at June 30, 1920	5,952	18	7
Ore, concentrates and other products			
On hand June 30, 1920 England	27,561	15	0
On hand June 30, 1920 Australia	75,716	11	5
Total	861,928	12	6

The company capitalization consists of 600,000 preference shares of £1 each and 600,000 ordinary shares of 15s. each. During the year an interim dividend of 5 per cent was paid upon the preference shares (£30,000), and a final dividend of 10 per cent on the preference and 15 per cent on the ordinary shares (£127,500). Accumulated profit on June 30, 1920, amounted to £437,006 10s. 4d.

Mining Dividends for January, 1921

The following is a partial list of dividends paid by mining companies during January, 1921:

Mining and Metallurgical Companies in the United States	Situation	Per Share	Totals
Am. Smelters, "A"	U. S.	$1.50 Q	$146,071
Am. Smelters, "B"	U. S.	1.25 Q	39,855
Caledonia, l. s.	Ida.	.01 M	26,050
Gold Chain, s. l. g.	Utah	.01 K	10,000
Grand Central, g.	Utah	.01 K	6,000
Miami Copper	Ariz.	.50 Q	373,557
North Star Mines, g.	Cal.	.03 K	7,500
Phelps Dodge, c.	U. S.	2.50 Q	1,125,000
Tamarack & Custer, l. s.	Idaho	.04 K	75,091
Tonopah Belmont, s. g.	Nev.	.05 Q	75,000
Tonopah Extension, g. s.	Nev.	.05 Q	64,140
United Eastern, g.	Ariz.	.15 Q	204,455
U. S. Sm., Ref. & Mining	U. S.-Mex.	.50 Q	175,557
U. S. Sm., Ref. & Mining, pfd	U. S.-Mex.	.87½ Q	425,555
Vanadium Corporation	Col.	1.00 Q	373,334
Mining and Metallurgical Companies in Canada, Mexico and Central America			
Asbestos Corp.	Que.	$3.50 Q	$105,000
Asbestos Corp., pfd.	Que.	3.75 Q	150,000
Dome Mines, g.	Ont.	.25 Q	100,000
Hollinger Consol. Gold	Ont.	.05 M	246,000
Howe Sound, c.	B. C.-Mex.	.05 Q	99,208
Kerr Lake, s. cobalt	Ont.	.12½ K	75,000
Lake Shore, g.	Ont.	.02 A	40,000
McIntyre-Porcupine, g.	Ont.	.05 Q	182,014
N. Y. & Hond. Ros., s. g.	C. A.	.30 Q	60,000
Nipissing, s.	Ont.	.50 QX	600,000
Silversmith (Slocan Star), s. l. s.	B. C.	..... K	25,000

A, annual; K, irregular. M, monthly. Q, quarterly. X, includes extra.

Alvarado Mining, Inspiration Consolidated, McKinley-Darragh, and Portland Gold mining companies all announced passing of dividends due at this time; but the U. S. Smelting, Refining & Mining Co. only reduced its common dividend to 50c. from the $1.50 paid since September, 1919. Gold Chain, Grand Central, North Star, and Tamarack & Custer companies reappear after intervals ranging from six months to eight years.

De Beers Consolidated Mines paid 75c. on its "American" shares on Jan. 27; Rand Mines, Ltd., English and American shares are now interchangeable, at rate of two American for five English shares, through the Bankers Trust Co.

MINING STOCKS

Week Ended January 29, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	....	....	*60		
Ahmeek	Boston	53	50	53	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	1/16	1/16	1/16		
Allouez	Boston	21	20	20	Mar. '19	1.00
Anaconda	New York	39⅞	37⅜	39½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅜	2⅜	2⅜		
Ariz. Com'l	Boston	8¼	8⅛	8⅛	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/16	1/16	1/16		
Bingham Mines	Boston	....	....	8⅛	Sept. '19, Q	.25
Calumet & Arizona	Boston	49½	48½	49½	Dec. '20, Q	1.00
Calumet & Hecla	Boston	249	245	245	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	10	10	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	32⅜	30⅛	30⅜	Dec. '20, Q	1.00
Chile Copper	New York	12⅜	11⅞	12⅜		
Chino	New York	22⅛	22⅛	22⅛	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*34	*33½	*34		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	2⅛	2⅛	2⅛		
Copper Range	Boston	34	33¼	33⅞	Sept. '20, Q	.50
CrystalCopper (new)	Boston Curb	*50	*35	*48		
Davis-Daly	Boston	7	6⅞	6⅞	Mar. '20, Q	.25
East Butte	Boston	9⅛	9⅛	9⅛	Dec. '19, A	.50
First National	Boston Curb	*90	*80	*85	Feb. '19, SA	.15
Franklin	Boston	2⅛	2⅛	2⅛		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	25	22⅛	23½	May '19, Q	1.25
Greene-Cananea	New York	23	22⅛	22⅞	Nov. '20, Q	.50
Hancock	Boston	3¼	3¼	3¼		
Howe Sound	N. Y. Curb	3⅛	3	3⅛	Jan. '21, Q	.05
Inspiration Consol.	New York	35⅛	34⅛	34⅛	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	7	Sept. '20, K	.25
Isle Royale	Boston	21⅛	20	21	Sept. '19, SA	.50
Kennecott	New York	20⅛	19⅛	19⅞	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1½		
Lake Copper	Boston	3	3	3		
La Salle	Boston	2	1½	2		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	23	23	23	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*8		
Mason Valley	Boston	2	1⅛	1⅛		
Mass Consolidated	Boston	2⅛	2⅛	2⅛	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4⅛	4⅛	4⅛		
Miami Copper	New York	19⅛	18⅛	18⅞	Jan. '21, Q	.50
Michigan	Boston	....	....	3		
Mohawk	Boston	46⅛	44⅛	46	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅛	5⅛	5⅛		
Nevada Consol.	New York	11⅛	11⅛	11⅛	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	16⅛	15⅛	15⅜	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	12	11⅛	11⅞	Oct. '18, Q	.25
North Lake	Boston	⅛	⅛	⅛		
Ohio Copper	N. Y. Curb	....	....	1/16		
Old Dominion	Boston	20	19⅛	19⅜	Dec. '18, Q	1.00
Osceola	Boston	29	29	29	June '20, Q	.50
Phelps Dodge	Open Mar.	....	†165	....	Jan. '21, Q	2.50
Quincy	Boston	40	39	40	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅞	12⅞	13⅞	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*50		
St. Mary's Min. Ld.	Boston	33	31	33	June '20, K	2.00
Seneca Copper	Boston	19	18½	19		
Shannon	Boston	1⅛	1	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅜	6	6	June '20, Q	.25
South Lake	Boston	1	1	1		
Superior Copper	Boston	4	3⅜	3⅜	Apr. '17,	1.00
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs	New York	9	8⅛	9	May '18, I	1000
Toulumne	Boston	*55	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	*29	*27	*28	Nov. '20, Q	.50
Utah Consol.	Boston	4⅛	4⅛	4⅛	Sept. '18,	.25
Utah Copper	New York	57⅛	55	57	Dec. '20, Q	1.50
Utah M. & T.	Boston	2 1/16	1⅛	2⅛	Dec. '17,	.30
Victoria	Boston	....	....	2		
Winona	Boston	*75	*60	*75		
Wolverine	Boston	13	11¼	13		
NICKEL-COPPER						
Internat. Nickel	New York	15⅜	15	15⅜	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	75	Nov. '20, Q	1.50
LEAD						
National Lead	New York	73	72⅛	72⅛	Dec. '20, Q	1.50
National Lead, pfd.	New York	104	104	104	Dec. '20, Q	1.75
St. Joseph Lead	New York	12⅛	12	12⅛	Dec. '20, QX	.50
Stewart	Boston Curb	....	....	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	9	9	9	May '17,	1.00
Am. Z. L. & S, pfd.	New York	29¾	26¾	26¾	Nov. '20, Q	1.50
Butte C. & Z.	New York	5⅛	5	5	June '18,	.50
Butte & Superior	New York	13⅜	13	13⅛	Sept. '17,	1.25
Callahan Zn-Ld	New York	6½	5⅛	6	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	....	....	157	Nov. '20, Q	4.00
Success	N. Y. Curb	*3	*2	*2⅛	July '16,	.03
Yellow Pine	Los Angeles	....	....	*45	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	7/8	7/8	7/8		
Alaska Juneau	New York	1¼	1⅛	1⅛		
Carson Hill	N. Y. Curb.	....	....	22¾		
Cresson Consol. G.	N. Y. Curb	....	....	1¼	June '20, Q	$0.10
Dome Extension	Toronto	*50	*50	*50		
Dome Mines	New York	12¼	11⅛	12¼	Jan. '21, Q	.25
Golden Cycle	Colo. Sprgs.	‡....	....	*73	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	6.72	6.30	6.65	Dec. '20, BM	.05
Homestake Mining	New York	50	50	50	Sept. '19,	.50
Kirkland Lake	Toronto	*50	*47	*50		
Lake Shore	Toronto	1.21	1.20	1.21	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.83	1.85	Jan. '21, K	.05
Porcupine Crown	Toronto	*21	*20	*20	July '17,	.03
Portland	Colo. Sprgs.	‡....	....	*60	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*4¼	*4¼	May '19,	.05
Silver Pick	N. Y. Curb	*10½	*8½	*9		
Teck Hughes	Toronto	*11	*10½	*10½		
Tom Reed	Los Angeles	1.16	1.13	1.15	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2 1/16	2⅜	Oct. '20, Q	.15
Vindicator Consol.	Colo. Sprgs.	‡....	....	*18	Jan. '20 Q	.01
West Dome Consol.	Toronto	*10⅜	*9	*10½		
White Caps Mining	N. Y. Curb	*10	*8	*8½		
Yukon Gold	Boston Curb	....	....	*60	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*33	*26	*29	Apr. '20, M	.03
Batopilas Mining	New York	....	....	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*36½	*35	*36	May '20, K	.03
Coniagas	Toronto	....	....	1.90	Nov. '20, Q	.12½
Crown Reserve	Toronto	....	....	*18	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Jan. '21, Q	.12½
La Rose	Toronto	*31	*31	*31	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*29	*28	*28	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.10	1.09	1.09	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	10	7	9	Jan. '21, QX	.50
Ontario Silver	New York	5⅛	5	5⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	⅜	⅜	⅜	Jan. '12,	.10
Peterson Lake	Toronto	*11	*9½	*10	Jan. '17,	.01½
Temiskaming	Toronto	*24½	*24	*24	Jan. '20, K	.04
Trethewey	Toronto	*19¼	*19	*19¾	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*2		
Barnes-King	Butte	‡....	....	1.11	Aug. '20, Q	.05
Boston & Montana	Boston	....	....	*63		
Cashboy	N. Y. Curb	*9	*7	*8		
El Salvador	N. Y. Curb	⅜	⅜	⅜		
Jim Butler	N. Y. Curb	*18	*16	*18	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*8	*6	*6	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*18	*15	*17	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1⅛	1⅛	1 1/16	Jan. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 1/16	1⅛	1⅛		
Tonopah-Extension	N. Y. Curb	1⅛	1⅛	1⅛	Jan. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Oct. '20, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1	1 1/32	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*17	*15	*15½	July '20, M	.01
Cardiff M. & M.	Salt Lake	1.25	1.25	1.25	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅞	2⅛	2⅛	Nov. '20, Q	.10
Consol. M. & S.	Montreal	19⅛	18⅛	19	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	3⅛	3⅛	3⅛	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Dec. '20, K	.25
Electric Point	Spokane	*7	*7	*7	May '20, SA	.03
Federal M. & S.	New York	8⅛	8⅛	8⅛	Jan. '09,	1.50
Federal M. & S., pfd.	New York	29⅛	27¼	29⅛	Dec. '20, Q	1.75
Florence Silver	Spokane	*16	*14	*16	Apr. '19,	.01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	4⅛	3⅞	4⅛	Dec. '20, QX	.15
Iron Blossom	N. Y. Curb	1/16	1/16	1/16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*10	*7	*9		
Prince Consol.	N. Y. Curb	1/16	1/16	1/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*8	*7½	*8	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*5	*5	*5		
South Hecla	Salt Lake	*70	*65	*70	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	1/16	1/16	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.05	1.95	1.95	Jan. '21, K	.04
Tintic Standard	Salt Lake	3.30	3.20	3.25	June '20, Q	.10
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*2	*4	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	....	....	*95	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	38⅛	36⅛	37⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	82	82	82	Oct. '20, Q	1.50
Asbestos Corp., pfd.	Montreal	95	93	95	Oct. '20, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	40⅛	37⅞	40⅛	Dec. '20, Q	1.00
Amer. Sm. & Ref. pf.	New York	81	80	81	Dec. '20, Q	1.75
Am. Sm. pf. A	New York	65½	65½	65½	Jan. '21, Q	1.50
U. S. Sm. R. & M.	New York	43⅜	43	43⅜	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	43¼	42½	42½	Jan. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

INDUSTRIAL NOTES

Power Trucks Valued as Winter Road Breakers

With the coming of winter and the heavy snowfalls in various parts of the country, the motor truck will assume the added duty of keeping these roads open for transportation. To warrant the expenditures which states and counties are making in their program of building and improving roads, thoroughfares must be kept open the year round, so that the business houses of the country, which are becoming more and more dependent on motor transportation for the conduct of their business, may obtain uninterrupted service during the winter months.

More than 2,000 FWD trucks, formerly government owned, are being used for road construction throughout the country. The FWD has proved itself unusually well adapted for snowplow work, because of the four-wheel-drive principle, which gives it power on all four wheels.

In conjunction with the use of snowplows on trucks for clearing miles of public roads, private concerns are also adopting this medium to facilitate transportation between particular points. During the heavy snows of last winter the Pride Pulp & Paper Co. of Tomahawk, Wis., kept four miles of road cleared from the railroad to the company's factory through the use of one of the FWD trucks with snowplow equipment. The Midwest Refining Co., Casper, Wyo., one of the largest operators of trucks in the West, is devoting a number of its FWD trucks to keeping roads open with the aid of snowplows.

Wahl Dewatering Machine Illustrated

Is Easy of Adjustment—Little Power Required—Large Tonnage Handled

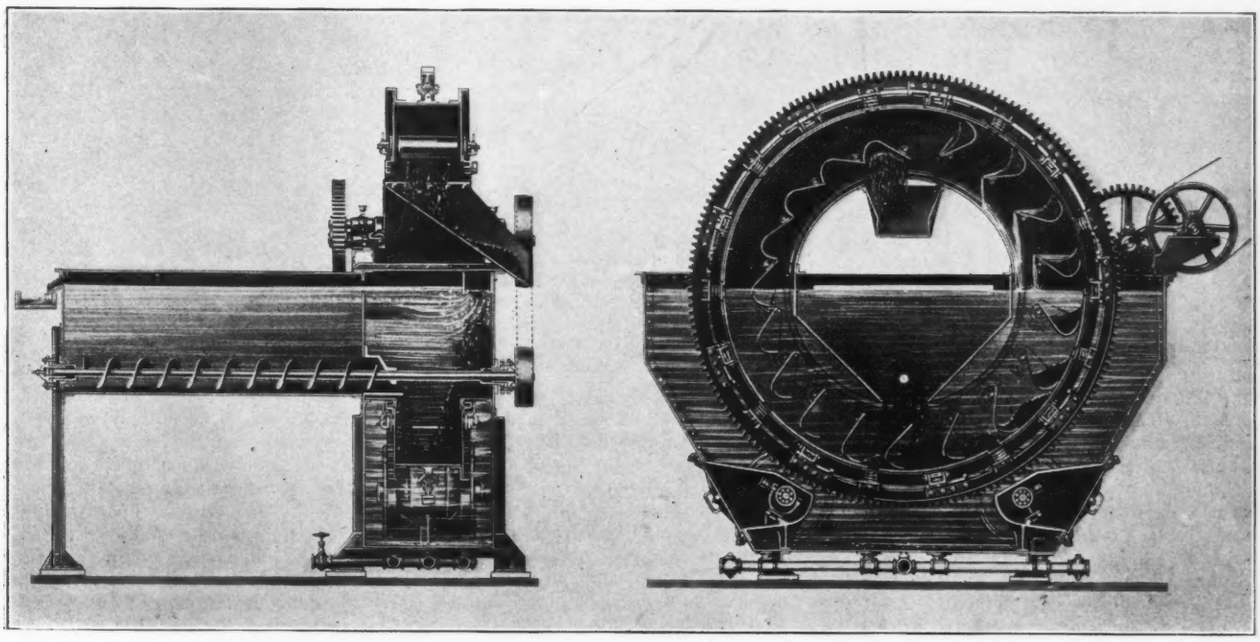
A new dewatering device has been designed by H. R. Wahl, mining and construction engineer and mill designer, First National Bank Building, Chicago, Ill. This machine is the outgrowth of Mr. Wahl's experiences in the lead mines of southeastern Missouri, where he had the problem of dewatering and disposing of large tonnages of concentrates and tailings.

The machine consists mainly of a deep, narrow water tank, containing a primary settling chamber within its upper central portion, and a feed inlet trough at one side. A supplemental elongated settling tank of V-shaped section joins the main tank at right angles to its side, and receives the overflow from the primary settling chamber through a narrow slotted opening in the upper part of the partition wall. Partly submerged within the main tank, and supported on two pairs of rollers, is a narrow-faced, open-end cylinder or rotor, of U-shaped cross-section, equipped with tires upon which it rotates, encircling the primary settling chamber. The rotor receives on the lower portion of its periphery the solids which have settled through the bottom outlet of the chamber.

Following the interior periphery of the rotor, a number of buckets are supported between its side plates, with sufficient clearance at both sides and end to allow the buckets to swing freely within proper limits, determined by adjustable stops at the bearing located on the outside of the rotor. When in operation, both rotor and buckets revolve together about the settling chamber, and thereby elevate, dewater, and discharge the solids from the machine without attrition.

The feed enters through the inlet trough at the top of the settling chamber. The coarser solids immediately sink through the bottom outlet of the chamber to the periphery of the rotor. The solids are then carried along by the revolving of the rotor. When the slope of the surface becomes too steep to retain them, they slide into the buckets. As the bottom of a bucket gradually assumes a horizontal position, the water is drained off over the inner edge.

At their uppermost position the buckets are automatically tripped and turned over, the outer edge of each bucket in turn striking the overturned edge of the preceding bucket, thereby completely discharging its contents into the discharge spout. The machine has a capacity of fifty tons of solids per hour and has a fourteen-foot rotor, but requires only two horsepower to operate.



LONGITUDINAL AND TRANSVERSE SECTIONS OF WAHL DEWATERING MACHINE

Industrial Housing a Factor in International Competition

"The significant feature about industrial housing is, that no amount of industrial prosperity, and, moreover, no leadership in international industrial competition, can be secured without giving proper consideration to the working classes. Upon the well-being of these classes, including the farmers, mechanics, the skilled and unskilled workmen and the small shopkeeper, depend the economic strength and prosperity of the nation at this time." This is a conclusion reached by many others also, but the General Fireproofing Co., in whose journal it was published, is actively at work illustrating the many ways in which it may be accomplished to the satisfaction of all concerned, including the general public of the industrial communities of this country.

Liquid Type vs. Magnetic Contractor Type Control

BY A. J. NICHT, JR.

The Davis Coal & Coke Co. had in operation an Allis-Chalmers double-drum hoist equipped with 350 hp., 550-volt, 60-cycle, 3-phase wound rotor induction motor. The control equipment was of the magnetic contactor type, manufactured by the Cutler-Hammer Mfg. Co. The hoist operated two cages in balance in a vertical shaft, the approximate hoisting distance being 500 ft., and a trip was made every thirty seconds. The power for the hoist was supplied from the coal company's central station, where a 2,500-kw. turbine carried the load of all the mines. In addition to hoisting load, there were some fairly large pump motors and eight rotary converters.

On account of the rapidity of the trips, the accelerating peaks on the hoist motor were naturally high, amounting to approximately 850 hp. torque. This caused considerable line disturbance, which was further augmented by the action of the magnetic controller being amplified as each successive switch closed.

About a year ago, it was decided to increase the output of the Kempton line by speeding up this hoist to a trip in twenty-two seconds. Calculations showed that the new conditions would require a 600-hp. hoist motor and that the peaks at acceleration would amount to a little over 1,000-hp. torque. On account of the greatly increased peak load, serious consideration was given to the advisability of using an equalizer set instead of an induction motor for the new conditions. This change would have involved a large first cost. After carefully analyzing the operating conditions, the use of a 600-hp. induction motor with liquid controller was recommended, and paradoxical as it may seem, the engineers advised that although the average and peak loads were considerably higher, the line fluctuations would not be greater than obtained with the 350-hp. motor and magnetic controller. After carefully considering all of the facts presented, the company finally decided to install the 600-hp. induction motor with liquid controller.

The marked regularity of operation obtained with the liquid controller was particularly noticeable. This is due to the gradual and uniform acceleration with the liquid type. The actual peaks at acceleration under the new conditions amount to very nearly 1,100 hp. torque, and even with this greater peak, the voltage fluctuation is decidedly less than obtained with the 850 hp. peak with the smaller motor. In fact, with the hoist operating in connection with the liquid control, the flickering of the incandescent lamps has been entirely eliminated. The results obtained indicate the possibility of connecting fairly large induction motor hoists to central station lines without causing serious line fluctuations, provided these motors are supplied with liquid controllers.

Automatic Mine Car Has No Projecting Devices

Practical experience has shown that 75 per cent of the repairs on mine cars are the result of damage to locking devices which project from the car body. The master mechanic and shop foreman of a large mining company in the West set out to overcome these defects, and the result is the M-Z automatic mine car now being built by the Colorado Iron Works Co., of Denver, Col., and shown in the accompanying figure.

The body and hinged end are automatically, positively locked when in normal position. By pressing a foot pedal they are easily released for dumping, while the operator has his hands free for rotating and tilting the car. The all-steel construction, roller-bearing chilled iron wheels and spring drawbars are a few of the items of an all-round rugged and appropriate construction conforming to long experience in operating mine cars. The manufacturers have demonstrated the truth of the claim that repairs to locking devices have been eliminated.

M-Z AUTOMATIC MINE CAR

Pacific Coast Branch Established by Engineering Business Exchange

The Engineering Business Exchange, whose home office is at 30 Church Street, New York City, announces the opening of a Pacific Coast branch with James T. Whittlesey as director and with offices in the Claus Spreckels Building, San Francisco, Cal. This will make available to the engineers and engineering industries of the Western coast states the same service in bringing together the buyers and sellers of engineering and technical business properties that is being rendered by the New York office of the exchange.

Mr. Whittlesey is a Yale graduate and has long experience in the street railway field, notably with the Brooklyn street railways. For a dozen years also he was chief engineer of the Public Service Electric Co. of New Jersey. He developed a comprehensive ten-year program for the unification of the various plants and systems in New Jersey. Since moving to California eight years ago he has been engaged in general consulting practice.

TRADE CATALOGS

Concentrators; Separators.—The Stebbins Engineering Co., Los Angeles, Cal., has issued a series of illustrated pamphlets describing the company's dry concentrator and the treatment of placer deposits. This company maintains a research department and ore-testing plant.

Oxy-acetylene Torches—Davis-Bournonville Co., Jersey City, N. J., has issued a very interesting description of its "Oxygraph," which is a combination of a motor-driven pantograph mounting with an oxy-acetylene torch, adapting the latter to the rapid, accurate cutting of pattern shapes out of tool steel up to 20 in. thick.

Pumps—The Aldrich Pump Co., Allentown, Pa., recently sent out its illustrated folder "Pump Data 48," describing its "pot-chamber water-end type" of pumps. The separate, interchangeable pots and direct waterways, hence no reversal inflow, are particular features of these machines. They should be specially efficient about mines, quarries and the like where large quantities of water, often of a corrosive composition, must be handled.

Pipe Fittings; Tools.—The Walworth Manufacturing Co., Boston, Mass., manufacturers since 1842 of a complete line of valves, fittings and tools for steam, water, air, and gas, has prepared and is now distributing a particularly interesting export catalog. This covers the company's entire line, including the genuine Walworth Stillson wrench, and is printed in four languages, English, French, Portuguese and Spanish. Each page of the catalog carries parallel text in the four languages named. It is distributed only in countries where British threads are standards. The domestic catalog (78) is used where American threads are standard.

Flotation Oils and Reagents—The Barrett Co., with headquarters at 17 Battery Place, New York City, and Salt Lake City, Utah, is one of the largest producers of coal-tar products in the world, and for some time has done a considerable business in flotation oils and reagents, and a special flotation oil department is maintained. A very intelligently written pamphlet describing the Barrett flotation products and their application has recently been issued. These products run all the way from a carefully standardized crude coal tar to the more advanced and complicated chemicals, such as alpha napthylamine xylidine and thiocarbanilid. Small samples for laboratory testing are furnished free. The wood oils are not handled by this company. "Very thorough investigations" according to the brochure, "have demonstrated. . . that coal-tar oils and products can replace other oils in most cases."